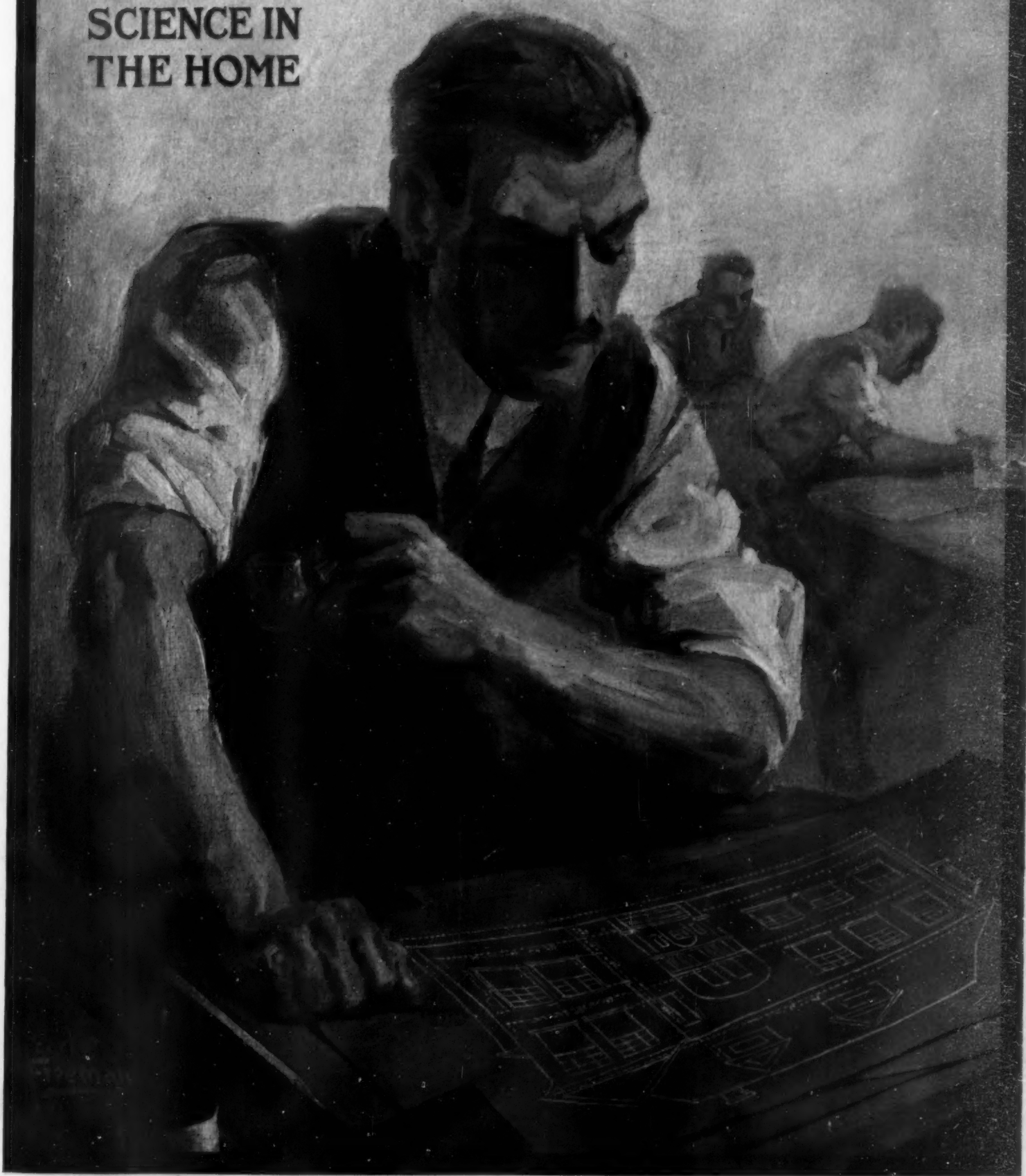


SCIENTIFIC AMERICAN

SCIENCE IN
THE HOME



Copyright 1912, by Munn & Co., Inc.

Vol. CVI. No. 15
April 13, 1912

Munn & Co., Inc., Publishers
New York, N. Y.

Price
15 Cents

Overland

Have You Seen this Magnificent 45 Horse-power Touring Car?

Wheel base, 115 inches; horse-power, 45; Bosch magneto; tires, 34 x 4 inch, quick detachable; finish—Brewster green, ivory stripe, all bright

parts nickel-plated; equipment—three black and nickel oil lamps, two black and nickel gas lamps with gas tank and horn. Price, \$1500.

IF not, do so quick! Waste no time—no words. Don't argue or ponder. Just see it. Don't ask the price until you have looked it over. Then give yourself a big surprise!

See the handsome rich finish—the dark Brewster green body, trimmed with heavy nickel plate—the long sweeping graceful fenders—the clean-cut pleasing lines—flush body—trim doors with inside handles—the big solid black lamps, nickel edged—the deeply cushioned leather seats—soft and comfortable as your easy chair. This gives you a faint idea of some of the comfort and beauty of the car. What is the price? \$1500.

There is not a car below \$1800 that can touch it. Take some of the mechanical facts and features. The wheel base of 115 inches—the powerful 45 horse-power motor—the big wheels and tires—the full-floating rear axle—the fine F. & S. annular and famous Timken bearings used—the aluminum crank

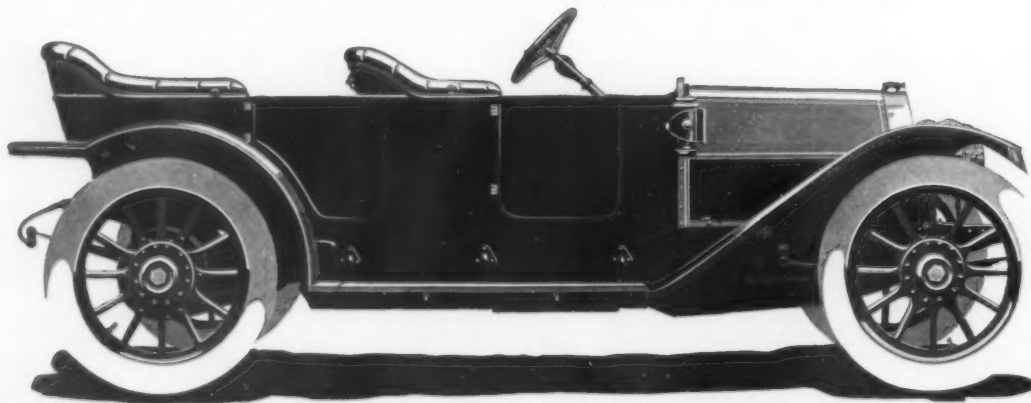
and gear casings—the Vanadium steel gears—the center control—Bosch magneto—the pressed steel frame with a double drop. Equipped with a self-starter—if you wish—only \$20 extra.

Do you find these specifications in any other car selling at less than \$1700 or \$1800?

The average manufacturer must charge you more for it costs him more to produce his car. Having the largest factory and the greatest facilities in the business we can give you for \$1500 what most other makers *must* get \$1800 for.

A comparison of cars will prove this statement. We don't ask you to take our word. Use your own judgment. Compare values and decide for yourself. Get the Overland dealer in your town on the phone to-day and make an appointment. Also send for one of our handsome catalogues, which gives you the whole detailed story. Please ask for book F 24.

The Willys-Overland Company, Toledo, Ohio



Which Tire?



No-Rim-Cut Tire 10% Oversize

Here is the Goodyear No-Rim-Cut tire—the hookless tire—the oversize tire.

The tire that cuts tire bills in two.

More than one million have been tested out. As a result, this tire outsells any other tire in existence.

Hookless Tires

Note that these tires have no hooks on the base.

They do not, like old types, need to hook into the rim flanges.

So your removable rim flanges are slipped to the opposite sides. Then they curve outward, not inward.

This tire, when wholly or partly deflated, rests on a rounded edge, and rim-cutting is made impossible.

126 Braided Wires

In the base of this tire run six flat bands of 126 braided wires.

They are vulcanized in to make the tire base unstretchable.

The tire can't come off because the base can't give. Nothing can force it over the rim flange. So hooks or tire bolts are not needed.

But, when you unlock and remove one of the flanges, the tire slips off like any quick-detachable.

It slips off much easier, because there are no hooks to "freeze" into the rim flanges.

10% Oversize

To take care of your extras—to give you an over-tired car—we make these tires 10 per cent over the rated size. And without extra charge.

That means 10 per cent more air—10 per cent added carrying capac-

ity. That saves the blow-outs due to over-loading. This 10 per cent oversize, under average conditions, adds 25 per cent to the tire mileage.

We Control It

This braided wire feature, which makes this type possible, is controlled by the Goodyear patents.

Single wires have been used—twisted wires have been used—to get this unstretchable tire base. But results are unsatisfactory.

These bands of braided wires, which need no welding—which cannot break or loosen—form the only way known to make satisfactory tires of this type.

No-Rim-Cut tires are satisfactory. Be careful to get them when you change to this type.



The Passing Type No Oversize

This is the old type—the hooked-base tire—which No-Rim-Cut tires are displacing.

23 per cent of these tires become rim-cut.

Yet these tires—wasteful and worrisome, and of lesser capacity—cost the same as Goodyear No-Rim-Cut Tires.

On Same Rims

This old-type tire—this clincher tire—is on the same rim as the No-Rim-Cut tire.

All standard rims take either type.

But the removable rim flanges are here set to curve inward—to grasp the hooks in the tire base and hold the tire on.

When this tire is wholly or partly deflated the thin edge of the flange digs into it. That is the cause of rim-cutting.

If this tire is punctured or run soft, it may be wrecked very quickly, and beyond repair.

Doubled Cost

This type of tire, under average conditions, means to double

one's tire cost over our new type.

It comes in this way:

Statistics show that 23 per cent of all ruined clincher tires are rim-cut.

And the smaller capacity, with the average car, cuts tire mileage 25 per cent.

These are net losses, because No-Rim-Cut tires now cost no more than other standard tires.

The 13-Year Tire

Goodyear tires as made today are the final result of 13 years spent in tire making.

We have compared in that time some 240 formulas and fabrics. We have compared every method of wrapping and vulcanizing.

They have been compared on tire testing machines, where four tires at a time are constantly worn out under all sorts of road conditions.

Thus we also compare all rival tires with our own.

The result is a tire which comes close to finality.

When this tire is made oversize—made so it can't rim-cut—it means the utmost in pneumatic tires.

Some 200,000 tire buyers have proved this. No-Rim-Cut tires have thus become the most popular tires in existence.

Our 1912 Tire Book, based on all our experience, is filled with facts you should know. Ask us to mail it to you.

GOOD YEAR

No-Rim-Cut Tires

With or Without Non-Skid Treads

THE GOODYEAR TIRE & RUBBER COMPANY, AKRON, OHIO

Branches and Agencies in 103 Principal Cities

Main Canadian Office, Toronto, Ont.

We Make All Kinds of Rubber Tires, Tire Accessories and Repair Outfits

Canadian Factory, Bowmanville, Ont.

Electricity Solves the Servant Problem

By doing the hard work, by abolishing drudgery, by making all work in the household easier, electricity makes servants unnecessary in many houses and more contented in all.

Electricity is that steady, tireless force, ever ready at the turn of a switch to light your house, cook your meals, bring cheery warmth to chilly corners or cooling breezes to stuffy rooms, run the sewing machine or turn the ice-cream freezer.

The General Electric Company has made these and many other uses of electricity as practical as they are convenient.

Electric Light for Every-body

When this Company produced the Edison Mazda Lamp—which gives double the amount of light formerly bought for a dollar—electric light became possible and practical for everybody's use.

So widespread is the demand for this lamp that now you can get it from lighting companies and electrical dealers everywhere. This lamp is so sturdy that it is used even for lighting automobiles, railroad trains and battleships.

Cook with Electricity

You can boil, broil, toast, roast, fry, grill and bake with electric heat. Ideal, isn't it? No dirt or ashes, no matches or danger, no oxygen-consuming flames—just a turn of a switch and the cooking begins.

This company has applied to electric cooking the same principles that make the G-E Electric Flatiron a necessity in half a million homes. This great advance is due to Calorite and the skillful way it is used in G-E products.

This Calorite is an almost indestructible metal that changes electricity into heat with remarkable rapidity and economy. It is used with marked success in our electric toasters, percolators, chafing dishes, grills and other cooking devices for home use. Calorite is produced only by the General Electric Company for exclusive use in G-E products.

Electric cooking has become so important that this Company has already produced scores of practical electric cookers, ranging in size from small hot plates to the great ranges and ovens used in hotels, steamships, etc.

Electric Power Does the Hard Work

Just as light and heat follow the turn of a switch so electricity instantly produces power for making household work easier. A little G-E electric motor runs the sewing-machine, operates the vacuum cleaner or washing machine, turns the ice-cream freezer, beats eggs, sharpens knives and cleans and polishes silverware.

In these small motors is applied all the skill gained by this Company's experience in making thousands of powerful motors that now turn the million wheels of great factories the world over.

A Cooler for a Scorcher

Like the man in Aesop's fable, electricity can "blow hot or cold at the same time." The wonderful force that heats the electric radiator or flatiron also runs an electric fan circulating cool, refreshing breezes in any room, day or night. These electric breezes insure healthful ventilation by driving out foul air and by forcing a steady volume of pure, fresh air into stuffy bedrooms or "close" kitchens.

A small and inexpensive fan—designed especially for use in homes and offices—is the G-E 8-inch Oscillating Fan, the only oscillating fan of its size on the market.

A Sick Room Necessity

Here the superior cleanliness, safety and convenience of electric light, heat and power make electricity indispensable. In summer the electric fan makes possible ventilation without drafts. In winter the grateful warmth from cheery luminous radiators follows instantly the turn of a switch. Appetizing toast or tea can be made, or the broth warmed, right at the bedside. A uniformly heated, and constantly warm flannel pad replaces the cumbersome hot water bottle.

On Sale in Your City

All the electrical conveniences mentioned above are carried in stock by lighting companies and electrical dealers everywhere. If you cannot get them promptly, send your dealer's name to our nearest office.

Goods Electrical of Guaranteed Excellence

The G-E trademark on goods electrical is the guarantee of excellence by the largest electrical manufacturer in the world. It represents

the broad experience gained by solving the big electrical problems of the country since Edison invented the incandescent lamp a third of a century ago. It is your guide to electrical goods of absolute reliability.

It is just as profitable for you to insist on seeing the G-E trademark on the electric lamps, fan or flatiron you buy as it is for great manufacturers and lighting companies to have G-E motors and generators in their plants.

Branch Offices in all Large Cities

In addition to large manufacturing plants in the eastern states, the General Electric Company maintains branch offices in 45 American cities. In these offices are specialists, trained in the many applications of electricity from the use of an electric flatiron to the operation of a generator large enough to supply power for all the public service requirements of a metropolis.

Address the office nearest you for specific information on the use of electricity in your home or business.

Six Interesting Booklets

"A New Era in Lighting"

Containing 22 pages on the lighting of homes, stores, offices, etc., and describes the Edison Mazda (Drawn Wire) Lamps.

"Electric Heating and Cooking"

Contains 60 pages on the many uses of electricity for cooking and heating.

"Fractional Horse Power Motors"

Contains 20 pages on the use of small motors in homes, stores, offices, etc.

"How to Solve the Sewing Problem"

Contains 12 pages on electric sewing.

"Fan Facts"

Contains 8 pages on the use of electric fans in homes and offices.

"Electricity on the Farm"

Contains 36 pages and shows how the farmer can easily have as many electrical conveniences as his city brother.

Any or all of the above will be sent on request to any reader of "Scientific American." Address your request to Dept. 59 of our Schenectady Office.

General Electric Company

Largest Electrical Manufacturer in the World

Principal Office: Schenectady, N. Y.

Sales Offices in the following Cities:

Atlanta, Ga.
Baltimore, Md.
Birmingham, Ala.
Boise, Idaho
Boston, Mass.
Buffalo, N. Y.
Butte, Mont.
Charleston, W. Va.
Charlotte, N. C.
Chattanooga, Tenn.
Chicago, Ill.
Cincinnati, Ohio

Cleveland, Ohio
Columbus, Ohio
Dayton, Ohio
Denver, Colo.
Detroit, Mich.
(Off. of Sol'g Agt.)
Erie, Pa.

Indianapolis, Ind.
Kansas City, Mo.
Los Angeles, Cal.
Louisville, Ky.
Macon, Ga.
Memphis, Tenn.
Milwaukee, Wis.
Minneapolis, Minn.

Nashville, Tenn.
New Haven, Conn.
New Orleans, La.
New York, N. Y.
Philadelphia, Pa.
Pittsburg, Pa.
Portland, Ore.

Providence, R. I.
Richmond, Va.
Springfield, Mass.
Rochester, N. Y.
Salt Lake City, Utah
San Francisco, Cal.
St. Louis, Mo.
Seattle, Wash.
Spokane, Wash.
Springfield, Mass.
Syracuse, N. Y.
Youngstown, Ohio



SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVI.]
NUMBER 15.]

NEW YORK, APRIL 13, 1912

15 CENTS
\$3.00 A YEAR

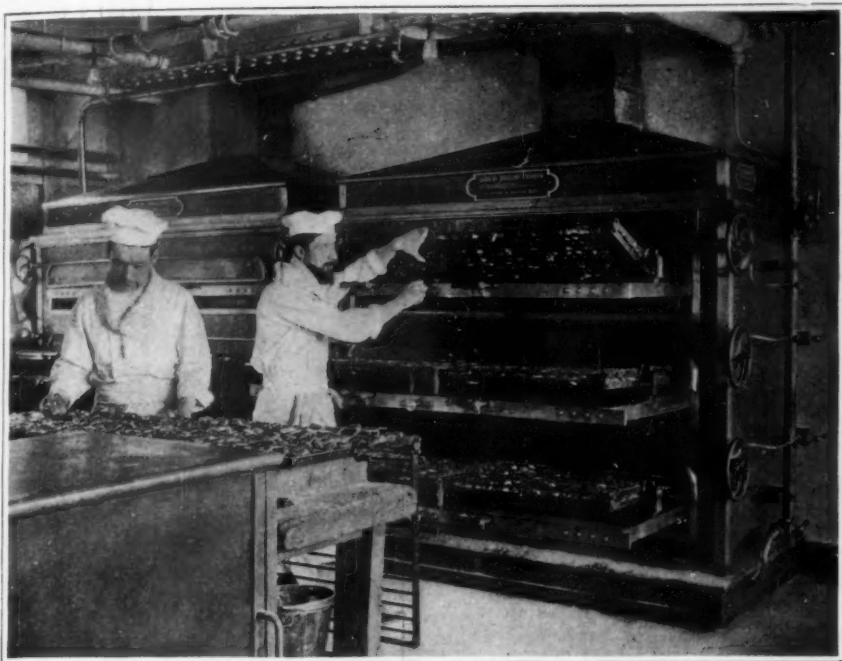


Fig. 1.—Salamander grill of the Samaritaine.



Fig. 2.—Frying kettles of the Samaritaine.

Broiling Seven Hundred Steaks in Six Minutes

Huge Gas-heated Grills and Ranges

By Jacques Boyer

ALTHOUGH gas has long been employed extensively for culinary purposes in America and many of our hotels and restaurants are equipped with gas ranges and ovens of colossal size, the following account of recent developments of the same kind in France is not devoid of interest.

Gas is now used for cooking in most Parisian private kitchens, from the tiny kitchenette of the cheap flat to the elaborate establishments ruled by the chefs of millionaires, but it has not hitherto been employed extensively in hotels, colleges, hospitals and other institutions in which large numbers of persons are fed daily. It has recently become possible to extend the use of gas to these great establishments, owing to the invention of ingenious apparatus which diminishes the number of cooks required, makes their work easier, and improves the quality of the cooked food without increasing its cost. Among the most remarkable examples of this apparatus are the huge gas-heated grills and ranges which have been installed in the new buildings of the Samaritaine Hospital, and which are here described and illustrated.

The Salamander grill (Fig. 1) is 16½ feet long, 6½ feet high and 3 feet deep. It is divided symmetrically into two compartments and contains six tipping steel grills on which about 700 steaks or chops can be broiled in six or seven minutes. Each compartment has a top of fire-clay and is heated by a row of gas-burners, which are opened as they are required and are ignited automatically by continuously-burning small jets. The grills are made in pairs, connected by hinges. The double grill is laid on a table, opened and charged with steaks or chops which are held securely in place when the grill is closed. The charged and closed grill is easily placed in the oven by two men, as it rests on supports which can be drawn forward. In a few minutes the meat is cooked on one side. The grill is then drawn out of the oven, turned over and replaced, to cook the other side.

The operation goes on methodically and incessantly, if necessary, and the consumption of gas is very small. From 200 to 250 cubic feet suffice to broil the 110 or 120 steaks or chops with which the grill is filled.

Hence the gas used for each steak or chop costs less than one-tenth of a cent. Furthermore, the meat is cooked in the best manner. As it is exposed to a sheet of flame below and the red-hot oven top above, a superficial crust is quickly formed, preventing the loss of the savory and nutritious juices. The loss of weight in broiling is diminished 20 per cent by the employment of gas.

The frying range of the Samaritaine comprises three huge kettles, two of which are shown in Fig. 2. Each kettle contains 650 pounds of grease which can be heated to the boiling point (300 deg. Fahr.) in thirty minutes by a battery of 102 Bunsen burners, and which suffices for frying 220 pounds of potatoes in two immersions of a total duration of fifteen minutes. The consumption of gas in this operation does not exceed 635 cubic feet, as many of the burners can be extinguished when the boiling point is attained.

This range has a total length of 18 feet and a depth of 52 inches, and is surmounted by a hood which collects the odors and vapors rising from the kettles. The products of combustion circulate about the kettles and are then conducted to a chimney.

The potatoes are placed in great wire baskets which are lowered into and raised from the hot grease by means of chain tackles. By detaching the front chains, the baskets can be tipped forward in order to discharge their contents into receptacles placed on wheeled tables, which are quickly rolled to the serving department.

The salamander grill and frying range here described suffice for the cooking of the 3,600 to 4,000 steaks and chops and 2,600 pounds of fried potatoes which are required, on certain days, for the breakfast of the Samaritaine's inmates.

New Discoveries at Boscoreale

DR. JOHAN BERGMAN conducts a vacation pilgrimage to Italy for Sweden's classical scholars. He has given the *Gotaburg Commercial Advertiser* the particulars about a newly discovered antique villa near Pompeii. Vineyard laborers happened upon this extraordinary ruin very recently. Ten rooms of it were

cleared before the Italian government stopped the owner's operations. More will be cleared when an Italian court has determined what indemnity the state must pay him for the property. Mount Vesuvius overwhelmed the new villa with volcanic ash and pumice coincidentally with Pompeii, A. D. 79. But its construction and decorations are of early Augustan date, and of princely magnificence. Only three Pompeian *suburbana* of equal splendor have been discovered. Bulwer-Lytton's "Villa of Diomed," found in the XVIII century, was the first. A second was uncovered at Boscoreale in 1895. It was there that De Prisco, a member of the Italian parliament, found 96 superb pieces of ancient silver plate, which he vainly offered to the Boston Museum of Fine Arts. Baron Rothschild of Paris hastened to acquire them for the Louvre Museum. The Metropolitan Museum owns several frescoes from the same ruin, and Mr. Morgan a charming bronze statuette. A third villa of fairly equal proportions was located at Boscoreale once more in 1900; but the condition of the paintings in its twenty-four apartments is deplorable.

The principal hall in the new Pompeian country-house has a fine mosaic pavement and is frescoed round about with twenty-nine life-size figures of men, women and children. The handsomest group is one of Bacchus and Ariadne. Elsewhere a naked infant reads a papyrus roll to a draped lady. Other nude figures wear fetters.

The nameless owner of this Campanian palace was not merely a connoisseur but an epicure. His kitchen is larger than any other Roman kitchen we know. One can easily picture him, as Cardinal Newman pictured his Roman grandee in a capital lecture, seeing his *batterie de cuisine* misexposed in the plate-glass showcases of a modern museum with infinite disgust. Newman's Roman senator orders the delicately decorated wrought bronze utensils back to the kitchen and pantry, and has the framed mosaic fragments of the antique gallery relaid on his dining-room floor.

Dr. Bergman's account is unillustrated; for easels, drafting boards and cameras remain tabooed on the disputed premises at Boscoreale.

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, APRIL 13, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President;
Frederick Converse Beach, Secretary and Treasurer;
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Copyright 1912 by Munn & Co., Inc.

Subscription Rates

Subscription one year	\$5.00
Postage prepaid in United States and possessions Mexico, Cuba, and Panama	
Subscriptions for Foreign Countries, one year, postage prepaid	4.50
Subscriptions for Canada, one year, postage prepaid	5.75

The Scientific American Publications

Scientific American (established 1845)	per year, \$5.00
Scientific American Supplement (established 1876)	" " 5.00
American Homes and Gardens	" " 5.00

The combined subscription rates and rates to foreign countries
including Canada, will be furnished upon application.

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated
articles on subjects of timely interest. If the photographs are *stuffy*,
the articles *short*, and the facts *authentic*, the contributions will
receive special attention. Accepted articles will be paid for at
regular space rates.

*The purpose of this journal is to record accu-
rately, simply, and interestingly, the world's
progress in scientific knowledge and industrial
achievement.*

The Church, Eugenics, and Immigration

"To be a good animal is the first requisite to success in
life, and to be a nation of good animals is the first condition
of national prosperity."—HERBERT SPENCER.

THE announcement of a prominent clergyman
that henceforth he would refuse to marry
men and women eugenically unfit for wed-
lock has been received with an outburst of approval
that shows how little Galton and his followers
realized the feeling of the public on a subject which
means vastly more to the preservation of society
than the discussion of such questions as tariff re-
vision and the abolition of the House of Lords. In
many of the writings of eugenists the hope is ex-
pressed that some day the public will realize the
meaning of heredity, and that some day legislators
will take the necessary steps to prevent an increase
of those elements in civilized populations which ul-
timately mean racial destruction. That the general
public has voiced its approval of the church's po-
sition shows that eugenic ideas had been making
their way far more rapidly than eugenists knew or
supposed.

Almost every newspaper and every scientific peri-
odical is publishing articles nowadays on the sub-
ject of eugenics. The terrible consequences of per-
mitting such criminal families as the Jukes and
the Zeros to saddle their countries with a thousand
and more defectives in the course of a few genera-
tions must surely be realized by almost every one
who can read black print. Instances of hereditary
insanity and criminality are brought to light daily
in the rapidly increasing literature on eugenics.
Thus, in Conklin's "Mating of the Unfit," we learn
of a young man of good family who, after his dis-
charge from the Continental army, mated a feeble-
minded girl in New Jersey. From this union came
a feeble-minded daughter, whose blood can be
traced in 480 descendants, of whom 143 were dis-
tinctly feeble-minded. In a paper read before the
Sixty-first Annual Session of the Medical Society
of the State of Pennsylvania last September, Dr.
Martin W. Barr, Chief Physician of the Pennsylv-
ania Training School for Feeble-minded Children,
cites some telling examples out of his own experi-
ence. He tells us that in Pennsylvania alone there
are 10,000 cases of avowed imbecility, and of these
but 3,500 are sequestered. At present the un-
sequestered feeble-minded are a distinct menace,
not only to the State of Pennsylvania, but to the
entire American nation. They are now privileged to
taint the race to which they belong; for as yet so-
ciety has taken no steps to protect itself from them.
Dr. Barr states that of 4,050 cases of imbecility, he
found 2,651, or 65.45 per cent, caused by malign
heredities, and of these 1,030, or 25.43 per cent, are
due to a direct inheritance of idiocy, and 280, or 6.91
per cent, to insanity.

In a recent number the *Medical Record* points out
that great danger lies for us in the tide of immi-
grants that pours into this country annually. True,
our law provides for the deportation of "all idiots,
imbeciles, feeble-minded persons, epileptics, insane
persons and persons who have been insane within

five years previous or persons who have had two or
more attacks of insanity at any time previously."
But the enforcement of the law is difficult.

In a bulletin published by the New York State
Hospitals, it is stated that until 1905 not more
than 35 immigrants were denied admission on ac-
count of insanity in any single year; but since that
time, and without any especial change in the law,
the number has risen to nearly 200 annually. More-
over, nearly as many defectives as insane persons
have been excluded. The immigration inspectors
undoubtedly do their best, but the Commissioner-
General of Immigration has himself pointed out how
inadequate are the means at his disposal for pre-
venting the pollution of American blood.

As might be expected, the influence of the im-
migrant is most clearly apparent in New York
State, for here 1 out of every 250 immigrants is
taken to a hospital for the insane in a year after
arrival. Evidence has also been collected, chiefly
by Dr. Isabelle Smart, which shows that no less
than 30 per cent of the feeble-minded in our popu-
lation may be traced to bad alien blood.

We take elaborate pains that diseased cattle shall
not be allowed to affect the public health, but as yet
we have done but little to protect the public health
from the far greater danger that lurks in bad human
blood. Some day a patriotism will be inculcated,
based upon a noble culture of racial purity, a
patriotism that will recognize the truth of Lord
Beaconsfield's dictum: "The public health is the
foundation on which reposes the happiness of the
people and the power of a country. The care of the
public health is the first duty of a statesman."

Capt. Scott at the South Pole

THE scientific world has been having a strug-
gle with its emotions of late. It is so very
difficult to maintain the correct attitude of
looking upon the attainment of the South Pole as a
relatively unimportant detail in the campaign of
antarctic exploration! One suspects that even
British *nil admirari*-ism would have succumbed if
Capt. Scott had chanced to reach the unacknowl-
edged goal ahead of his Norwegian colleague. As
matters stand, however, the British have been able
to console themselves by falling back upon an ortho-
dox disdain for polar "dashes."

As to the explorers themselves, there has been a
marked difference in their immediate aims and mo-
tives that partly accounts for the sequence of events
up to date. There is not the least doubt that the
achievement of what an English journal properly
terms the "athletic feat" of reaching the pole ahead
of anybody else was the primary object of Amund-
sen's undertaking in the antarctic; though, we
hasten to add, this broad-minded leader did not con-
sult his own taste in the matter. He made a de-
liberate concession to popular ideals for the purpose
of winning financial support toward an enterprise
that did not, in itself, strongly appeal to the public;
viz., his proposed five-year drift across the north
polar basin. Similar devious means to philosophic
ends have often been resorted to by scientific men.
One might cite many analogous though less sensa-
tional cases, for instance, in the relations between
some of our government scientific bureaus and the
holders of the national purse strings!

The German and English expeditions contrast
strongly with Amundsen's impromptu assault upon
the pole. Lieut. Filchner's undertaking has been
conducted with true German deliberateness; first an
elaborate campaign of oceanographic work was car-
ried out in the South Atlantic; then a series of very
interesting meteorological observations with sound-
ing balloons in South Georgia; and finally, on the
10th of last December, the "Deutschland" set sail
for Antarctica, whence Filchner did not expect to re-
turn until the winter (i.e., the southern summer) of
1913-14.

The gratifying news that has just come from
Scott indicates that he has carried out his plans so
far in the same spirit. He may or may not have
reached the pole during the past winter. Probably
he did. His narrative up to the beginning of Janu-
ary, recently given to the world, tells of a hard
struggle; but both the experience of Amundsen and
our general knowledge of antarctic meteorology and
topography indicate that in the subsequent stages
of his journey he would find all the physical con-
ditions much more favorable. Especially we have
reason to believe that the terrific blizzards char-
acteristic of the fringe of the great continental
glacier must become less and less severe as one
travels to the interior.

Be this as it may, the fact remains that the
English expedition has thus far made a more sub-
stantial contribution to the world's knowledge of
Antarctica than any of its competitors. Enough

material has already been gathered to make up a
report comparable with the splendid series of vol-
umes which constitute an imperishable monument to
Scott's previous explorations of 1901-04.

No Englishman of science will have reason to feel
chagrined at the comparative results of Scott's and
Amundsen's undertakings—even if Scott never gets
nearer to the pole than he was when last heard
from.

Nationalism and Internationalism in Science

PATRIOTISM is a spirit which manifests it-
self in various forms, not always wholly com-
mendable. Indeed, a cynic might define it as
a propensity for making a noise about achievements
toward which the "patriot" himself has contributed
nothing. Hardly anyone, however, would be dis-
posed to disparage the just pride felt by the coun-
tryman of a Newton, a Helmholtz, a Pasteur, or, to
come right home, of such a representative of typical
American genius as Thomas Alva Edison. True
it is that most of us who indulge in this kind of self-
congratulation may have taken at most but a van-
ishingly small part in the boasted achievements; yet
the spirit of patriotic self-complacency in these
things is justifiable, if only for the stimulating
atmosphere which it breeds. Indeed, the average
man of lesser attainment may be thus indirectly
doing his share in at least providing the requisite
conditions under which the genius can thrive and
produce his invaluable life-work.

But this patriotism, this nationalism, in science,
as in other things, has its limitations. The field of
science is far too vast to allow us to proceed each
on his own way, heedless of the work, the inspiring
co-operation of others. Nationalism is a natural thing
and a good thing, but something more is needed.
And so for many years past it has been the custom
for the foremost national scientific societies to ar-
range at intervals international meetings, at which
men of science from all the corners of the earth
have met to interchange ideas and to report on the
progress of science in their home countries.
Hitherto, however, there has been no very definite
system, no special organization to regulate and ar-
range international affairs in the field of science.

It is seasonable to refer to these matters at this
juncture, for on the one hand, in a few months' time
this country will for the first time receive as its
guests the members of the International Congress of
Applied Chemistry. On the other hand, one of the
most active promoters of the movement for inter-
nationalism, Dr. P. H. Eijkman (The Hague), is a
visitor on our shores at the present time. The prob-
lem which the Foundation for the Promotion of In-
ternationalism has decided to face and solve is well
brought out in the words of Prof. Shuster, quoted
as the motto in Dr. Eijkman's book on Scientific
Internationalism:

"For these reasons the last twenty-five years have
witnessed the formation of a number of international
organizations which have done excellent work, but
which now begin to multiply in a manner which
opens out a new danger calling, if overlapping and
mutual interference is to be prevented, for a com-
mon bond between the various bodies: an organiza-
tion of organizations."

A more detailed description of the subject, giv-
ing a survey of the present situation and its needs,
and an account of the work which has been done
toward establishing a central bureau devoted to the
supervision of internationalism of science, will be
found in the current issue of our SUPPLEMENT. The
matter is one which deserves the careful attention
of every reader.

Port Sudan

A RECENT consular report tells of the re-
markable growth of this important port, which
was opened by the Sudan government in 1905,
36 miles north of Suakin, on the Red Sea, as a
terminus for the Sudanese railways. Quays have
recently been completed capable of berthing 5,000-
ton steamers, but these are already far from ade-
quate to the rapidly growing business of the port.
Steamers of eleven lines now touch here regularly.
The railway from Sennar to Port Sudan, opened
four years ago, makes possible the delivery of goods
from Port Sudan to Khartum in twelve hours. The
commerce of the Sudan, which finds its outlet at
this port, is growing at a great rate; the cotton in-
dustry alone promises to rival that of the Missis-
sippi Valley and the Egyptian delta. The railway
system has now been pushed far south of Khartum,
and is expected to reach El Obeid early in 1912.
Africa is truly becoming the despair of cartograph-
ers; for the accurate maps of yesterday are obso-
lete to-day; especially as to the railway routes.

Engineering

Power from the Tides.—Study has been made of a proposition for generating power for Schleswig-Holstein by utilizing the ebb and flow of the tide, and work is under construction. The island of Nordstrand is being connected with the mainland by a high-water reservoir of 1,500 acres and a low-water reservoir of 1,250 acres. There will always be a head of water in one or other of the reservoirs, which will be available for operating turbines connected to continuous-current dynamos.

Canada's Appropriation for Engineering Improvements.—The Canadian government has appropriated \$38,000,000 to carry out its railway and canal programme for the coming year. This includes the building of the first section of the Hudson Bay Railroad and the construction work on the eastern division of the Grand Trunk Pacific from Winnipeg to Moncton, the Quebec bridge, surveys looking to the deepening of the Welland canal, work on the Trent canal, and the Intercolony Railway and the Prince Edward Island Railway. In connection with the deepening of the Welland canal some fear has been expressed that it might lead to the diversion of Canadian wheat shipments to New York by way of Oswego and the Erie canal, but George P. Graham, the ex-Minister of Railways and Canals, in advocating the bill gave it as his opinion that once through the Welland canal the shipments would naturally be transported down the St. Lawrence.

Passing of Pennsylvania's Jersey City Terminal.—Since the completion of the Seventh Avenue and 32nd Street terminal of the Pennsylvania Railroad very little use has been made of the terminal at Jersey City. The ferry service has dropped off to a considerable extent. At present the terminal is used by a few Pennsylvania trains and by the trains of the Lehigh Valley Line. On August 1st the Lehigh Valley will use the Communipaw terminal of the Jersey Central, and there will be no further need for running the ferry service from the old Pennsylvania terminal except for local Jersey City use. It is reported that the passenger trains will be discontinued entirely and the station will be converted into a freight and express terminal. When the tunnel route under the Hudson River was first proposed many stoutly declared that they would not use the under-water route. Evidently the passage under the river has completely lost its terrors, for now there is no more popular way of traveling from New York to New Jersey.

Government Railroad in Alaska.—When the Panama canal is completed what shall be done with the construction material employed in the work? Shall it be put to use on some other great engineering enterprise or sold as junk at considerable loss? Secretary Fisher of the Interior suggests that a railroad be built from Seward to the Matanuska coal fields in Alaska, and with the materials taken from the Panama canal. In the construction of the canal there were about 375 miles of rails and ties and about 40 locomotives and 800 cars, most of which are flat cars. These could readily be converted into coal cars. The principal obstacle to the transfer of the material will be found in the fact that a 5-foot gage is used on the Panama canal, and it would be necessary to cut the gage of the cars and locomotives down to the standard of 4 feet 8 inches. Secretary Fisher, in recommending this work, shows that the new road, if continued on to Fairbanks and finally to the Tanana River, which runs into the Yukon, would provide a line of communication throughout the length of Alaska and would open up a vast territory for further development.

The Extent of the Pennsylvania Railroad.—The vastness of the Pennsylvania Railroad system and the number of people dependent upon it is indicated in a report showing that on December 31st, 1911, it had 25,236.5 miles of track, the greatest in the history of the company. The Pennsylvania Railroad system has 11,503.76 miles of line, of which 6,329.54 miles are east of Pittsburgh, and the remainder, 5,174.22, west of Pittsburgh. These lines run through thirteen States and the District of Columbia, in which live more than one-half of the people of the United States. The system now has 11,503.76 miles of first track, 3,593.03 miles of second track, 798.41 miles of third track, and 619.03 miles of fourth track. It has also 8,722.27 miles of sidings. The increase in the trackage during 1911 was 619.92 miles. The Pennsylvania Railroad is essentially an institution of the State of Pennsylvania, and in it are located 4,134.07 of the 11,503.76 miles of line. Ohio is second in Pennsylvania mileage, having a total of 1,932.56 miles. In Indiana the system has 1,659.92 miles of line, while the remainder is divided as follows: Delaware, 275.34 miles; District of Columbia, 13.02 miles; Illinois, 642.43 miles; Kentucky, 4.07 miles; Maryland, 601.90 miles; Michigan, 439.99 miles; Missouri, 30.78 miles; New Jersey, 750.17 miles; New York, 822.57 miles; Virginia, 77.87 miles, and West Virginia, 89.07 miles.

Electricity

New Substitute for Hard Rubber, Gutta Percha and Leather.—A new product, based on common seaweed, which is found in such unlimited abundance, is announced as the result of many years of experiment in England. Many scientists have foreseen the enormous possibilities afforded by seaweed, and the material just discovered, called Seagumite, bids fair to exceed all expectations, as it is of special value in all electrical industries, being a non-inflammable insulation of high dielectric strength, proof against heat, cold, oils and weather. A singular property is the increase in insulation resistance following immersion in water. The material is unaffected by dilute sulphuric acid, which makes it well adapted to storage-battery jars and separators. Among associated mechanical uses, Seagumite seems well adapted for motor gears, switchboard panels, switch handles, steam and gas packings, especially for high pressures. The product is also well suited to replace leather in belting and all the other varied uses of leather.

Wireless and Aviation in the Sahara.—One of the chief difficulties in flying over the desert, that of guidance, bids fair to be greatly lessened, if not entirely obviated, by a recent discovery of Signor Marconi, a discovery which was, in fact, only announced on the thirtieth of last December. The inventor, upon his return from a professional visit of observation to Tripoli, announced that in sending wireless messages across the desert, no poles or masts are needed. It is only necessary to lay the wires along the sand for a short distance in the direction in which the message is to be sent, and the apparatus performs its functions as perfectly as usual, if not better than before. This is due to the complete dryness and non-conductivity of the sand. It is said, moreover, that under these circumstances messages cannot be intercepted. The advantages are obvious, especially for military use. The discarding of the masts means an immediate saving in bulk and weight, since the rest of the apparatus can be packed in a comparatively small case; consequently transportation is tremendously facilitated. Furthermore, the chief difficulty of installation consists in the erection of the masts, while they also constitute at once a target and means of betrayal to the enemy. From these considerations it is clear that the lucky discovery that they may be dispensed with will greatly facilitate the application of wireless telegraphy to aeroplane service in desert countries, and the direction of the movement of flying machines.

New Non-corrodible Metal Coating of Iron and Steel.

—A new process similar to galvanizing, but giving instead of a zinc coating one of lead or lead alloy, has been introduced. The cost as compared with galvanizing depends on the character of alloy deposited, being less for some alloys and greater for others. A much thinner coating may be secured. After cleaning by sandblast or pickling, the article to be coated is immersed for a time not exceeding two minutes in a special bath which cleanses the pores of oxygen, and which also deposits an amalgamating agent over the surface when the article is dipped in the bath of molten metal, thereby insuring an integral union or chemical weld between the surface and the coating metal. The well known resistive qualities of lead to sulphuric and sulphurous acid fumes renders this process applicable to all metal parts exposed to such corrosive atmospheres, especially in electric railway work, for the overhead and track appliances, including tie-plates and angle plates and the steel sheathing of cars. A coating consisting of 100 lead and 1 tin suits most conditions as it is very pliable as well as very resistant, but various alloys of lead, tin and zinc may be employed according to the use to which the treated article is to be put.

Loud-speaking Telephone Annunciator.—A special application of the telephone has come into use in the announcing of the departure and arrival of trains in railroad stations. The official who announces the outgoing trains speaks into a special water-cooled telephone transmitter installed in a booth conveniently placed and from which his voice is telephonically transmitted and reproduced in no less than sixteen loud speaking receivers with amplifying horns connected in multiple and distributed throughout the waiting rooms. Incoming trains are announced from the same transmitter by throwing a switch to connect a separate circuit of ten of the loud speaking receivers installed on the track levels below the waiting room floor. By this indirect telephone method a single announcement serves for all the waiting rooms. The articulation is simultaneously reproduced, with equal volume of sound, in all the receivers, and by installing several receivers at equal distances in each of the large inclosed spaces which make up the waiting rooms, the enunciation in exact unison not only fills the space, but obviates the confusion of echoes.

Science

The Order of Merit for Sir J. J. Thomson.—King George IV has appointed Sir J. J. Thomson to the Order of Merit. The distinction has been conferred also in the past upon Lord Rayleigh, Dr. Alfred Russel Wallace, and Sir William Crookes.

A Tablet to Dr. Crawford W. Long.—On March 30th, a medallion to Dr. Crawford W. Long was unveiled at the University of Pennsylvania. The day marked the seventieth anniversary of his use of ether as an anesthetic. Dr. Long was a member of the class of 1839 of the University of Pennsylvania.

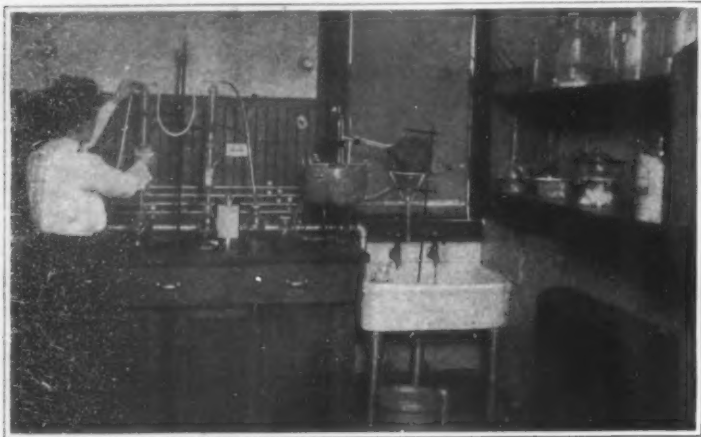
Potash in "Borax Lake."—The two federal bureaus engaged in the search for potash—the Bureau of Soils of the Department of Agriculture and the Geological Survey of the Department of the Interior—are in receipt of promising news from their field representatives. A potash deposit of apparently great importance has been discovered at Borax or Searles Lake in the northwestern corner of San Bernardino County, California.

A Medal to Dr. Brooks.—Dr. William R. Brooks, director of Smith Observatory and professor of astronomy at Hobart College, Geneva, N. Y., has been awarded the Comet Medal of the Astronomical Society of the Pacific for his discovery of the Brooks comet of 1911. This is the tenth medal received by Dr. Brooks from this society, including the first medal which it awarded to any astronomer. The Paris Academy of Sciences bestowed upon him the Lalande prize medal a few years ago; and the Astronomical Society of Mexico its gold medal and diploma for his discoveries of comets, now numbering twenty-six in all.

Tantalum as a Substitute for Platinum.—According to *Nature* the use of metallic tantalum had been proposed for standard weights. Owing to the high price of platinum, a suitable substitute had long been looked for. Tantalum is not attacked by any acid (hydrofluoric acid excepted) and is not affected by atmospheric influences. It was suggested to make a series of 100 gramme weights of this metal, for use in chemical research. The cost, it is claimed, would not be more than one-third of the iridium-platinum weights now in use.

An American Chronometer.—A well-known New England watch making firm has recently brought out a very interesting type of chronometer. The ordinary "ship chronometer," commonly called the "box chronometer," is provided with a peculiar and sensitive escapement technically known as the "chronometer escapement," but while that form of escapement is satisfactory for stationary time pieces, such as a ship chronometer practically is, it is not considered safe for pocket watches. On the other hand, the detached lever escapement, which is entirely safe for pocket watches, is also sufficiently trustworthy and accurate for use in ship chronometers. This new American box chronometer is fitted with a detached lever escapement. Most foreign made chronometers require daily winding, but the American chronometer in question is found to maintain a uniform rate if wound every four days. Foreign chronometers cost from \$200 to \$350 or more. This detached lever chronometer costs \$60. This American product, while thoroughly reliable, is intended for the use of pleasure boats, yachts, and craft whose voyages do not extend far from the coast, rather than for large ocean steamers.

A Perpetual Calendar Conference.—An international conference upon the subject of an international perpetual calendar will meet at Geneva, Switzerland, next summer. Of the many suggestions that will be discussed one will be that of Leroy S. Boyd. His perpetual calendar has thirteen months of twenty-eight days each, which makes a total of 364 days. The extra or 365th day of the year is not counted in any month, but precedes the first day of January as New Year's Day. In leap years the 366th day is not counted in any month, but follows the last day of December as leap year day. The additional month is named Solaris, and comes between June and July. The year 1916 is taken as an illustration as, according to the present calendar, that year will begin on Saturday, which would become New Year Day, 1916, under the perpetual calendar. The following day, Sunday, would become January 1st, 1916. In the perpetual calendar each month has the same number of days; every month and every week begins on Sunday and ends on Saturday. The same date in each month falls on the same day of the week. A printed calendar for each month will be unnecessary, as the days of each month are identical with those of the first month. The calendar is good for all time to come, and, like Bill Nye's Railway Guide, "will be just as good two years ago as it was next spring." It will facilitate business calculations. A month will mean 28 and not 30 or 31 days. Wages by the week, fortnight and month are readily adjustable without even referring to the calendar, which is easily committed to memory.



Research laboratory for advanced students in nutrition.



Laboratory of advanced chemistry and physiology.

The School of Household Arts of Columbia University

The First University Foundation for Technical Training in Management of the Home

By Benjamin R. Andrews

WOMAN'S higher education is a development of the last fifty years: First of all the effort was to repeat in the women's colleges the academic training which was being given men in men's colleges. So the co-educational institutions of the West, the separate women's colleges of the East, and affiliated women's colleges like Barnard at Columbia, and Radcliffe at Harvard, have been developed in the last generation or so. These colleges have served to carry further the general cultural and academic training which has been open to young women. In the last decade or two public education has felt the influence of the demand for vocational training, and technical high schools, practical arts high schools, and other types of secondary schools which fit boys and girls for practical work, have come in. On the level of collegiate education, the same change has for a longer time been taking place in the education of men, so that professional schools of law, engineering, agriculture and other subjects, have been organized and made an element in the university scheme of education. The latest development on the university level is that women shall have the same type of specialized professional education in their fields of interest as has been provided men. So the School of Household Arts at Teachers' College, Columbia University, was organized in 1909 and appears as the first great university foundation developed for the technical training of women in their peculiar province of household management.

This school was developed as a division of Teachers' College, the professional School of Education of Columbia University, and as such its first purpose was the training of teachers in household arts. Historically, indeed, the training of household arts teachers was one of the first undertakings of Teachers' College, as the college itself dates back to philanthropic classes in the household arts which were carried on in New York city in the early eighties. The association which conducted these classes came to the conclusion that any wide-spread efforts at betterment must be conducted through the public schools and that the training of teachers was the central point of attack in any

such effort. Accordingly, Teachers' College was organized in 1888 and from the first the training of teachers in home subjects has been one of its departments. Teachers were first trained in cookery and related work, and then in the sewing arts, and about ten years ago courses for graduate nurses were added to prepare them for positions in hospital administration and nurses' education, and soon after a department of household administration was organized to fit young women for positions of responsibility in the administration of private households and the larger institutional households as college and school dormitories, orphan asylums, and other institutions. Finally, in 1908 and 1909, when a gift of a half million dollars for a household arts building had come, these four divisions of work, domestic science, domestic art, hospital economics, and domestic administration, were reorganized into the School of Household Arts. This school, while continuing the technical training of teachers of household arts has found it possible, through the possession of its unique equipment, to branch out into the technical training of women in many new fields. Young women who wish to teach household arts find the school a gateway to positions as college instructors of household science, as directors and instructors of household arts in normal schools, secondary schools, technical and trade schools; and finally as supervisors and teachers of household arts in the public elementary schools.

The School of Household Arts also equips for a wide range of technical vocations, aside from teaching, in its various divisions of household management, home cookery, household administration, house decoration, dietetics, institutional cookery, lunch-room management, nursery management, laundry management, and similar technical and industrial fields. Persons who are not familiar with these fields have little idea of the wide range of opportunity which is opening to young women to-day. Every dormitory, orphanage, hospital and other institution has its department of house-keeping and general supervision, and trained women are increasingly in demand for these responsibilities. The commissary department of such institutions is

often a professional field by itself in which the trained dietitian finds her calling. The person trained as a food specialist and manager, may undertake the direction of public school lunch rooms, lunch rooms in the industrial and commercial establishments, and even commercial lunch rooms, as some women are beginning to do throughout the country. The direction of the institution laundry is another field in which trained women are in demand. Within the past half-year a dozen calls have come to the School of Household Arts for women either as teachers or supervisors of laundry work. Young women whose gifts are artistic rather than executive can find openings in house decoration and furnishings, either as independent workers or in affiliation with architects and mercantile houses. While costume design and illustration is another applied art field which has business as well as educational opportunities. Something of the attention which the School of Household Arts is attracting, is evidenced by its registration which for the current year numbers 353 resident students who are candidates for certificates, diplomas, and degrees in education or in technical work, and 396 part-time students, young women of New York and its suburbs who come to the School for practical instruction in foods and cookery, design, dressmaking, millinery and management. The school is really a college in itself, and, with a faculty numbering fifty-eight, gives instruction in some eighty-eight courses.

The Household Arts Building, which was completed in 1909 at a cost of a half million dollars, is itself an index of the purpose and scope of the school which it shelters. It represents a complete equipment for instruction. The basement, which is quite above ground, gives space for a household management laboratory and for a laundry laboratory. The latter is equipped with fixed tubs, ironing tables and other necessary apparatus for hand laundry work; here, also, is the typical apparatus of a power laundry, including the wash-wheel, extractor, mangle, and steam-drying room. This room makes possible instruction in domestic laundering and also in the conduct of institutional laundries as they exist in hospitals, dormitories and other large



Laboratory for the study of household chemistry.



A row of gas ranges in the cooking laboratory.

THE SCHOOL OF HOUSEHOLD ARTS OF COLUMBIA UNIVERSITY

households. The first floor of the building is devoted to the administrative staff of the school and to professional offices.

The department of foods and cookery occupies the entire second floor, which furnishes three main cooking laboratories, each accommodating thirty students, the desk equipment varying in each laboratory, according to its purpose, whether intended for beginners or for advanced students. A fourth laboratory, for class exercises in institutional cookery or large quantity cookery, is provided at the end of these laboratories, with typical hotel equipment, including a refrigerator, range and all other necessary apparatus for cooking and serving. Adjoining this room is the table service laboratory, a room providing space for exercises in table setting and in service of meals on both domestic and institutional levels. In these rooms, during the past half year, to mention typical pieces of teaching, an advanced class prepared and served a luncheon, one day weekly, to some thirty or forty persons. Another laboratory is equipped for experiments and problem work in cookery.

The department of textiles and clothing occupies the third floor, with four large laboratories for instruction in garment making, dressmaking, and millinery. The department of household chemistry, physiological chemistry, and nutrition are quartered on the fourth floor, where three large laboratories, which accommodate thirty students each, are provided. There are also advanced laboratories in household chemistry and physiological chemistry, and on the floor above, there is a research laboratory for advanced students in nutrition, providing all necessary equipment for investigations in human and animal nutrition.

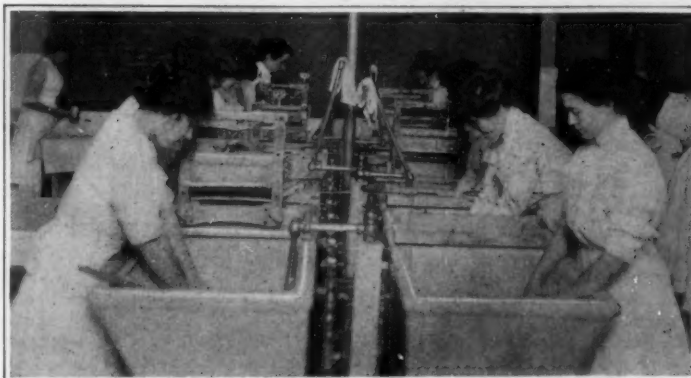
On the fifth floor are also to be found four studios for household art and textile instruction, and a demonstration, or model apartment, for teaching purposes. The demonstration apartment adjoins the nutrition research laboratory, so that during research work, it will be possible to have the subjects live in the apartment under experimental conditions. The appointments for household art referred to include two large studios for elementary and advanced instruction in household art, designing, house decoration, and costume design, and also a smaller studio for advanced and graduate students. The textile laboratory provides unique equipment for chemical and microscopic studies of textile fibers and fabrics, apparatus for instruction and experimental work in dyeing, and other equipment necessary for the development of instruction intended to educate the purchaser of textiles. The model apartment is used for problems in house decoration and for practice in housewifery, house nursing and other practical subjects.

Here then, in this metropolitan university, is a great technical school devoted to the training of women in the arts and sciences of the household, having its place along with the academic colleges of cultural training, and the older professional schools. The response which has come in registration, to the opening of this new school shows that the women of the country are awake to the importance of the home, and are determined to bring to its support the best that science and art can offer.

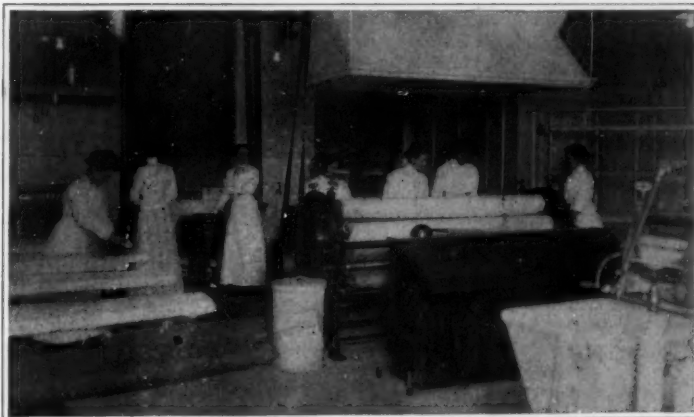
Carl Auer von Welsbach, the Inventor of the Incandescent Light Mantle

IN not a few instances a line of research originally undertaken with purely scientific ends in view, has ultimately led to results of the highest technical value. About the year 1880 a young man, Carl Auer von Welsbach, was occupied in Bunsen's laboratory in the University of Heidelberg, with an investigation in the chemistry of the so-called rare earths—a group of elements whose separation and isolation presents very considerable difficulty to the chemist.

Welsbach was struck by the bright glare and peculiar spectrum which *erlin*—one of these rare earths—gave out when introduced into the non-luminous bunsen flame. The observation was made in the normal way, by holding a small amount of the substance, supported upon a platinum wire, in the flame of the burner. Then the thought occurred to the young student that a much stronger effect might be obtained by impregnating a web of vegetable fiber with a solution of a rare earth salt, and placing the resulting structure in the flame. In this way the cotton fabric was burnt off, leaving a skeleton of the rare oxide, similar in general build and appearance to the incandescent mantles of to-day. The first mantle was made from lan-



A class in domestic laundry work.



Power machinery in the laundry laboratory.

thanum oxide; this at first sight appeared to give satisfactory results. On standing it however took up moisture from the air, and crumbled to powder. This difficulty was overcome by incorporating a certain amount of magnesia with the lanthana, but the mantle thus produced lost its porous structure and became glassy after a few days' burning. Great progress was made by the introduction of zirconia and thoria, and with these materials the first commercial mantles were made in 1886. The efficiency of the lamps placed on the market about this time was 10 to 15 candle-power per cubic foot of gas, and the falling off of the luminosity was considerably greater than in the modern mantle.

The fortunes of the enterprises which undertook the commercial exploitation of the Welsbach mantle have been somewhat checkered. At first Dr. Welsbach per-

sonally directed the preparation of the impregnating fluid, which was manufactured at Vienna, while the turners were made by the Pintsch Company of Berlin. About 1888, a separate fluid-factory was installed in the United States. The lamp for some time found a fairly ready sale, partly owing to its novelty. In point of efficiency, however, it failed to come up to expectations, and thus its advantages over existing systems proved insufficient to counterbalance the annoyances caused by the breaking and shrinking of the mantles. Hence for some time a serious depression fell upon the mantle trade. In the meantime every effort was made to overcome the defects which stood in the way of complete success. The first improvement made by Welsbach was to reinforce the head of the mantle, where it is gathered and attached to the mantle carrier. He also strengthened the mantle by dipping the upper extremity in a special solution, which imparted greater strength to this portion. In spite of these lesser improvements, however, the business situation did not mend, but became more and more unfavorable, until finally Welsbach took on himself the entire burden of the enterprise, hopeless though it appeared at the time. He continued his researches, working with a quantity of raw thorium oxide which happened to be in the factory when he took it over. By repeated crystallizations he prepared successive batches of thorium of increasing purity, and to his surprise found that with the purest thorium oxide obtainable, the mantle gave practically no illumination. This forced upon him the conclusion that thorium was not the essentially luminous element, and that his principal problem must be to discover the true cause of the luminosity of the raw thorium oxide. In this he soon succeeded—it transpired that

cerium was the element responsible for the high luminous effect. Strangely enough, however, the best results are obtained where only a comparatively small proportion—one per cent—of this is present, the remaining 99 per cent being made up of thorium. This discovery proved of the utmost importance, and from that time on (about 1890) the success of the system was assured.

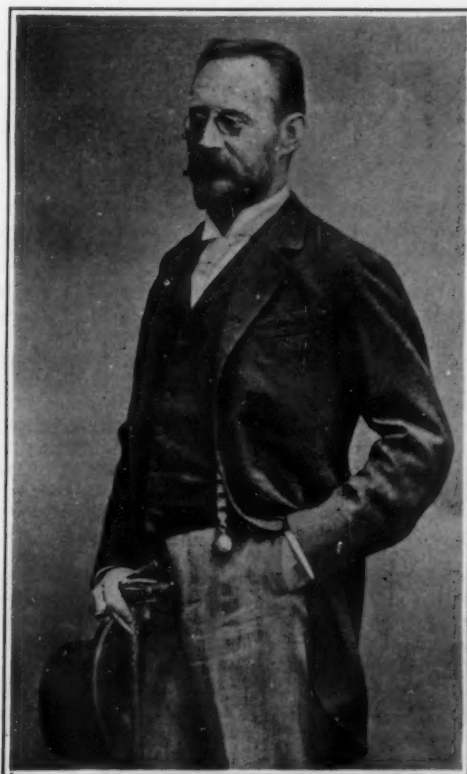
Another application of the rare earths to which Welsbach has made important contributions is the preparation of "pyrophoric" alloys. This term is used to designate certain metallic alloys which have the peculiar property of giving out long flashes of bright sparks when scratched with a piece of iron or steel. Dr. Welsbach investigated these alloys, and showed that the rare earth metals are pyrophoric only when alloyed with other metals, particularly iron.

While most of Welsbach's scientific investigations have been connected with the rare earths, he has not restricted himself entirely to this field. For many years he has been interested in the metallic filament electric lamp, in the development of which he has taken an active part. The metal to be used in such a lamp must fulfill the requirement of possessing a very high melting point. The metal selected by Welsbach was osmium. The osmium lamp, however, has not come into extensive use, a rival having sprung up in the tungsten and tantalum lamps. While the main development of these has taken place in the hands of others, Dr. Welsbach himself also experimented with tungsten, and in 1906 was making tungsten lamps at the rate of some 400 a day.

Thus we see that Carl Auer von Welsbach not only developed from the beginning to its present state of perfection the incandescent mantle now in such general use, but that to him must be accorded also the credit of having done pioneer work in the production of the metallic filament lamp. And if the pursuit of chemistry along highly scientific lines formed the starting point of Welsbach's technical career, his work has been marked throughout by the intensely scientific and rigorously systematic method which pervades it.

It has been remarked that men who work without a plan may stumble upon occasional important discoveries and inventions, but that the scientific man, following a definite course, has much greater assurance of a regular harvest of results. These are then not merely of the nature of occasional "lucky strokes," but come rather as the necessary consequence of a well devised campaign.

May this brief sketch, the material for which is derived from an article published by George S. Barrows, in the Transactions of the Illuminating Engineering Society, serve as an appreciation both of the man, and of the scientific method for which he stands.



Carl Auer von Welsbach.

Motion Study in the Household

Reducing the Cost of Work in Effort and Time

By Frank B. Gilbreth

A CRITICAL study of the manual operations of an individual in doing a piece of work will almost invariably disclose a host of useless motions. The result of such a study should be to give the world less fatigue and better work, and to the worker greater capacity and greater rewards in money, in leisure or in any other form of compensation that he or she may desire.

Because Motion Study happened to find its first application in the industries, and because the examples of motion saving that have received most publicity have been drawn from the trades, the average reader may easily infer that Motion Study is applicable to, and is really at present confined to, that particular field. This belief is strengthened by the fact that the vocabulary of Motion Study has become tinged with mechanical phrases that rather repel the novice. As a matter of fact all that is needed to show any reader that such study is applicable to his special field is to translate the laws or principles of Motion Study into the vocabulary of his work. So, for example, to show that Motion Study is applicable to the household, we need only tell of its theory and practice in the language of house management. It is this that the present article proposes to do.

The motions made by each member of the household should be taken up in order to determine, (1) whether the motion is a part of work that must or should be done in the household, (2) if the work is necessary, by which member of the household it can best be performed, (3) whether the selected worker is performing the work according to the best method, (4) whether the motion is a necessary part or element of the method, and (5) whether the necessary motion is performed in the best manner possible.

When the first two facts have been determined as exactly as they can be before motions are studied, the method of doing the work must be derived. This should be done by dividing the work into its motions, by examining and testing each motion, and by building synthetically from those motions that stand the test, a standard method of doing the work.

Variables Affecting Motions.

Now, what are the tests by which a motion is examined, analyzed and measured? Every motion is affected by a great number of variables, or changing influences. These variables that affect the motion have been grouped under three headings.*

I. Variables of the Worker, or of the individual making the motion.

- | | |
|-------------------|---------------------|
| 1. Anatomy. | 9. Health. |
| 2. Brawn. | 10. Mode of living. |
| 3. Contentment. | 11. Nutrition. |
| 4. Creed. | 12. Size. |
| 5. Earning power. | 13. Skill. |
| 6. Experience. | 14. Temperament. |
| 7. Fatigue. | 15. Training. |
| 8. Habits. | |

II. Variables of the Surroundings, Equipment, and Tools, or of the environment and the means by which the motion is made.

- | | |
|--|--|
| 1. Appliances. | 8. Reward and punishment. |
| 2. Clothes. | |
| 3. Colors. | 9. Size of unit moved. |
| 4. Entertainment, music, reading, etc. | 10. Special fatigue-eliminating devices. |
| 5. Heating, Cooling, Ventilating. | 11. Surroundings. |
| 6. Lighting. | 12. Tools. |
| 7. Quality of material. | 13. Union rules. |
| | 14. Weight of unit moved. |

III. Variables of the Motions, or manner in which the motion is made.

- | | |
|---|--------------------------------------|
| 1. Acceleration. | 7. Foot-pounds of work accomplished. |
| 2. Automaticity. | |
| 3. Combination with other motions and sequence. | 8. Inertia and momentum overcome. |
| 4. Cost. | 9. Length. |
| 5. Direction. | 10. Necessity. |
| 6. Effectiveness. | 11. Path. |
| | 12. "Play for position." |
| | 13. Speed. |

At first sight, this classified list may seem appalling to the student of household management. This, again, is largely a matter of unfamiliar and unattractive names. The ideas embodied are simple, every day, and most practical.

The aim of discovering and classifying all these variables is to enable the student to consider all the

elements of the problem that he is to solve, i. e., which is the most valuable motion; to furnish a standard by which results may be estimated; and to show the method of getting results that will have permanent value.

Being persuaded that Motion Study should be applied to work in the household, how can the student of household management best set to work to make the application?

Selecting the Worker.

The first group of variables, it will be noted, offers an admirable field for the individual housewife to study, as upon her devolves the task of selecting the worker. She, having decided what work she must have done, or would prefer to have done in her house, must determine what type of worker can best do the work. Or, if she is limited in her opportunities for selection, she must accept the worker available and determine from study of her what work it is possible and profitable to attempt to do. In either case, a study of the worker is necessary before attempting to prescribe motions.

There is nothing more important in this study than observing habits of work, and trying to substitute and establish right habits. It is difficult to change old, well established habits; for some types, almost impossible. The inexperienced worker usually offers the best field for teaching right habits of work. These are taught by insisting upon right motions, first, and speed, second. Quality is a resultant by-product, the product being right habits of work, one of the most important and far-reaching results of Motion Study.

If the worker is only temporary, like a visiting seamstress, it may not pay to insist on prescribing motions; if she is permanent, it will pay to spend time and effort on seeing that her experience is properly acquired.

Causes of Fatigue.

The study of fatigue, and the provision for proper rest is most important. There are three causes for fatigue: (a) Fatigue from coming to work improperly rested; (b) unnecessary fatigue, due to unnecessary work or motions, or uncomfortable conditions of working, and (c) necessary fatigue due to effective work. The first two of these may be eliminated or greatly lessened. Unnecessary fatigue may be cut down by providing proper equipment. For example, a washing machine will decrease fatigue enormously. So will a fireless cooker, which eliminates the need for scouring pots and pans; so will a dumb waiter, where cooked meals must be carried from one floor to another. Although Motion Study will suggest new devices for elimination of motions, that is not its prime purpose. The devices are a resultant by-product, rather than an aim. Again, excellent equipment may be rendered less fatiguing than it would otherwise be by care in selecting additional equipment. A chair of proper height and adjustable back will greatly lessen the fatigue of running a sewing machine. Many housewives have learned the advantage of a comfortable chair used with a specially designed ironing board. A crowded or cluttered workroom is still another cause of unnecessary fatigue. A pantry in disorder, or with poorly arranged materials and utensils makes cooking a long and tiring process. Standardized placing of equipment, such as illustrated by the kitchen cabinet, method of lighting, etc., can do much to economize strength and efficiency.

Necessary fatigue must be determined, and rest provided for. The amount of rest needed, and the intervals at which rest periods should come varies with the work and with the worker. For example, work done at one season of the year only, like preparing fruit for preserving, finds the worker out of practice, with unaccustomed muscles, and requires far more frequent rest periods than would the same work if it were performed daily. Rest periods do not necessarily imply doing nothing. The worker may utilize the time to do other work of a different character. It is now recognized in the industries that frequent short periods of complete rest, followed by longer periods of strenuous work, will cause greater outputs of work with less fatigue than the old formerly accepted method of working continuously at a gait that can be maintained all through the entire working day. It is also recognized that a constantly maintained even temperature is enervating, while changes of temperature, such as cooling the air by opening the windows, or doors for a few minutes, or going into a cooler room, say once an hour, are stimulating and eliminate fatigue.

The Housewife's Equipment.

In studying the second group of variables, those of the surroundings, equipment and tools, the housewife will be encouraged to find that some pioneer work has been, and is being done in such a way that the results are available to all. Mrs. Mary Pattison, has established in Colonia, N. J., a Household Experiment Station, where household surroundings, equipment and tools are being tested, with the aim of standardizing the results of the tests, and placing the standards at the disposal of all students of household economics. Mrs. Pattison's own account of her work will make clearer than could any description here, the great assistance that she stands ready to give all who desire to receive it. Her work can be appreciated only by being actually seen.

The Variables of the Motion furnish a large field for close and intensive study. The number of needless motions that are daily made in all the households, if saved, would be sufficient to build houses for all the poor and to plant and harvest crops for all the hungry, and would still give more leisure time for all, to utilize according to their individual wishes.

It is but a short time ago that there was no method known for determining methods of least waste and ultimate motion economy. To-day we have provided methods of measuring for determining the most efficient motions, and for recording the necessary, the efficient, and the least fatiguing motions. We have already determined the most efficient motions for many trades, and have already revolutionized the work of the bricklayer, for example, so that now he can do his day's work with one-third the fatigue formerly experienced. With the perfection of our new method of recording the three dimensions of the path of all human motions, we are able to record exactly which motions require the least foot-pounds of work and which require the least time for their execution. We can now for the first time record the time and path of individual motions to the thousandth of a minute, without the human error in recording which entered into the old method of taking time study.

It is not expected that such scientific motion study and time study shall be made immediately in every home, neither is it expected that the members of every household will all be experts in motion economy, but there are many savings that can be made in any household simply by planning the work ahead. The use of such devices as the daily reminder file and a study of the work and schedules carefully laid out a week, or even one day, ahead will result in eliminating many useless motions.

Count Motions and Eliminate Unnecessary Ones.

One method that has been found effective is to count the motions made in any simple often repeated operation, such as the making of a bed, and then to plan out how to do the work with the fewest steps and the fewest motions of the arms and hands. A little practice with the mere determination of eliminating all unnecessary motions will usually result in dividing the number of motions used by three or four and oftentimes more. The by-product is usually a better method of performing the same work.

The greatest economy of motions in the household will not be obtained until the house itself is designed with this saving in view.

The results of Motion Study in the Household are:

1. That work becomes better; that more work is done; that work is standardized, and that cost is lowered. In other words, quantity is raised, quality is improved and maintained; the cost is lowered, and more time is obtained for rest and recreation.

2. These results are important, but far more important are the results to the worker, be she housewife or helper. The worker receives greater reward in that form of pay that she most values, be it wages, leisure, working capacity or skill. She has the benefits of all available appliances, and the assurance that, constantly, improved appliances will be made to meet her intelligent demands.

The manufacturers of household tools and utensils have devoted their time more to the designing of articles that will sell than to articles that could be used to obtain greatest economy. In this they have undoubtedly been wise, for tools designed to give the greatest economy would not give that economy unless the users knew exactly how to make the correct motions to use them for best results. For example, how few workers in the household would be able to use efficiently

(Continued on page 327.)

* See "Motion Study," D. Van Nostrand & Co., New York.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Rotary Mimeograph Case

To the Editor of the SCIENTIFIC AMERICAN:

I have read with considerable interest the various comments from the press with reference to the rotary mimeograph case, and am rather surprised to discover the attitude that these critics seem to take toward the patent rights and the patent law in general, and the decision relative to this case by our Supreme Court.

They seem in their hatred of trusts and their monopolistic abuses, to have slopped over and lost their balance when applied to a lawful patent right issued by the Government to an inventor who has produced and invented a novelty, or any other useful article, and which said patent has only a limited time to run.

They seem to take the position that it is impossible to write or print anything without the mimeograph, and the public are absolutely tied to this machine, or without it they must go without literature or writing.

It is laughable to note the comparisons that some make, and evidently with the view of warping the public mind, for I can not believe that the writer is honest when he says, "Think of a man selling a cooking stove and requiring him to bake in it only such things as are sold by the seller of the stove."

He seems to forget that there are numerous stoves, and that no one is obliged to buy any particular stove with such agreements attached thereto, and if he does so, certainly should be obliged to submit to the conditions under which he makes his purchase.

As long as my memory runs, the patent law has been regarded by most people as being one of the most beneficent institutions in our country, and one of the greatest incentives to originality and invention in this wonderful inventive age.

Why some modern critics seem to take exceptions to the profit that should come to a patentee during the limited term in which he has secured a monopoly of his invention, is beyond me to discover.

They seem to place the patent right in that same class of illegal monopolies, and to regard the inventor and discoverer, rather than a great benefactor, a menace to the community.

To me it has always seemed that the patentee's rights have not been protected to the extent that is warranted by his importance to the country, and I would think it a calamity should the demagogic opposition to our present patent law, and the senseless cry for its abolishment, have any weight with the thinking public.

The objections to our Supreme Court's decision relative to this question strike me as having their origin more in blind passion and lack of sound reasoning, than in common sense. EDWIN W. MOORING.

Waterbury, Conn.

A Question of Definitions and First Principles

To the Editor of the SCIENTIFIC AMERICAN:

In an editorial, March 23rd, this statement is made: "Many biologists are compelled to postulate the origin of living matter from non-living at some time in the history of the cosmos. For in the first place, 'life' cannot be considered an ultimate fact, like energy or matter; at any rate, the scientist finds that his investigations yield more and more satisfactory results if he assumes that 'life' is not an entity."

If the power of life manifested in organic, or living matter is not an entity, what is it? Take, for instance, the idea expressed in the editorial referred to. We all recognize the idea, apart from the printed page, as something that existed in the mind of the writer, and which now exists in the minds of thousands of others, who, like myself, have read the article. Is the idea matter? Is the idea energy? Will any theory of matter or energy account for the production of thought without the aid of that peculiar power we call life? I suppose we all recognize that an idea ever remains an idea, just as a particle of carbon ever remains a particle of carbon, or a given amount of energy ever remains a given amount of energy, regardless of the combinations it may enter into, or the various changes it may undergo. There are certain peculiar manifestations of power, of life, that are not observed when we study the manifestation of matter and energy apart from life. One is the power of reproduction of its like; thus the editor in writing out his idea, neither lost it, nor changed it into copy, but he set such forces to work on the entities, matter and energy, that the like of his idea was reproduced in the minds of many readers. When I read the printed page, I do not think of the idea as being in the ink and paper before me, but rather as existing in the mind of him who expressed it in words that were printed. It is the arrangement of the

words, for which the writer alone is responsible, that produces an idea in my mind, not, perhaps, exactly as it existed in his mind, but like it; as nearly as the education of my mind will allow.

It seems to me as though science was on the wrong tack when it "postulates the origin of living matter from the non-living" without a previous existence of life to cause it; or to refuse to consider life as an "ultimate fact," while there are so many powers of life and mind that apparently have no connection with either matter or energy, more than matter and energy have with each other. Of course, we all want to know the truth of what really exists. H. BETTES.

Barre, Mass.

[If science is on the wrong tack in postulating the emergence of living from non-living, or in refusing to consider life as an "ultimate fact," we may trust that the method of science will sooner or later disclose the error. For the truth of the scientist lays no claim to being absolute; it is always held subject to revision when new experience makes revision necessary. As long as the assumption that life is a phenomenon resulting from certain complex chemical and physical combinations yields further insight into and control of vital processes, the scientist will hold to this assumption; when he finds a different assumption yielding better results, he will adopt that one. As to the "many powers of life and mind that apparently have no connection with either matter or energy," we know of none such. The analogy between "ideas" and carbon atoms is faulty because the writer does not know what the ultimate units of "ideas" are. On the other hand, the analogy between "ideas" and living things, as capable of reproducing themselves, would be of more weight if ideas (assumed to be ultimate realities) were shown to reproduce in the same manner as living things. The description in our correspondent's letter fits a catalytic process better than it does anything "living," and catalytic processes certainly come into the world of the chemical and physical.—EDITOR.]

Fast Track Laying

To the Editor of the SCIENTIFIC AMERICAN:

The SCIENTIFIC AMERICAN recently spoke of the track laid on the Baro Kana Railway in northern Nigeria as a record—6 1/3 miles main line and 1,200 feet of siding being laid in one day.

Reference in the clipping to track laying on our western prairies fails to state that the feat in this line performed by J. S. & D. T. Casement during the construction of the Union Pacific Railway through Nebraska in 1867-8. It was no uncommon thing for them to lay four miles, and it was, I think, the latter part of the summer of 1867 that seven miles and 1,940 feet of track were laid complete in one day. There is, no doubt, record of this in the archives of the Union Pacific Railway, and can be verified. I was in a position to know this, being brother-in-law of D. T. Casement, and connected with construction at railhead.

You will find on computation that "we" laid 4,260 feet more than the record you give, and without the aid of modern track-laying machinery.

Dubuque, Iowa.

E. C. LOCKWOOD.

A Defense of the Wireless Meddler

To the Editor of the SCIENTIFIC AMERICAN:

I have just read your article entitled, "Curbing the Wireless Meddler," and am truly surprised to see your most excellent magazine publish such a one-sided and unfair argument. A question of such merits and importance as this should be considered from every point of view.

I am a wireless amateur and am pretty well acquainted with conditions as they exist in this city, having owned and operated a station for over six years. In all my experience, I can recall no instance when an amateur, or so-called meddler, has willfully interfered with dispatches of an official character. On the other hand, I can tell of many cases in which they have been a great help, I myself having more than once copied and relayed messages to the navy yard, when they could not get them. There was another instance where an amateur picked up a distress call from a Great Lake steamer, and thereby saved the lives of many people. There were no authorized operators on the job at the time.

The Government is largely to blame for their inability to cope with interference, on account of employing instruments that are antiquated and unfit for their present needs. I know of tests having been made here with first-class apparatus, which enabled high-powered equipments within a two-mile radius to be tuned out so completely that stations one and two hundred miles away could be read with ease. For some unknown reason, the system has never been adopted.

Of course, there are some who operate stations merely for their own pastime, and care not how much they annoy or disturb others; but you will find these in every branch of trade. Any person who would mali-

ciously do so criminal an act as to willfully break up messages which involve loss of life and property, should be severely punished by law. However, this is no reason why the innocent should suffer. To put the experimenters out of business would be to place a strong hindrance on the advancement of the art.

There seems to be only one fair way to deal with the subject, and it would remove all future trouble. Every station should be licensed, and the different grades of outfits should be compelled to operate under a stated wave length. If efficient tuning apparatus is employed for both sending and receiving, it will enable all classes to work at all times without interfering with the others. Failure to comply with these requirements should be punishable by law, and the offender's license should be withdrawn in each case.

I trust that the views of one who seems to be on the offending side have not been boring in their contents, and that they will give the people at large an idea of conditions as they really do exist. Certainly, to deprive the amateur of his equipment would cut him out of an innocent means of enjoyment that in many cases would be supplanted with one of a less moral character.

Washington, D. C.

EDWIN L. POWELL.

[A careful reading of the article "Curbing the Wireless Meddler," hardly justifies the criticism of the amateur operator in his interesting letter. Unfortunately, the records of the Navy Department describe many instances of willful amateur interference with official dispatches. Moreover, willful interference constitutes but a fraction of the amateur interference, which, however, unintentional, is the natural result of the existence of the amateur system. No system of radiotelegraphy yet invented is "amateur-proof." The writer's remedy for interference—the licensing of all stations—plus scientific organization—was advanced in the above article as the only practicable method of attack. The amateur who is willing, out of consideration for public interests, to operate his station within prescribed limits of wave length and power at reasonable distances from public stations, need not be alarmed at the possibility of government regulation.—EDITOR.]

Our Wonderful Bodies

To the Editor of the SCIENTIFIC AMERICAN:

There are upward of two million openings in the skin, which are the outlets of an equal number of sweat glands. The blood which passes through the heart every minute is equal to the whole quantity in the body. The full capacity of the lungs is about three hundred and twenty cubic inches. The capacity of the stomach is about five pints. There are more than five hundred separate muscles in the body. The heart weighs from eight to twelve ounces. It beats about one hundred thousand times in twenty-four hours. Each perspiratory duct is one-quarter inch long, and the length of the whole about nine miles. The average man takes about one ton nourishment, solid and liquid, annually. About thirty hogsheds of air are inhaled by a man every hour of his life. The great toe is placed on the inside of the foot to act as a fulcrum in propelling the body. The patella or knee-pan projects in front of the knee to afford a better fulcrum for some of the muscles of motion. The fingers are of unequal length, because by reason of this fact they are able to grasp objects of any size. The bones never touch each other, but are separated by their membranes, because if they did touch, there would be less elasticity of motion.

Each ear has four bones. The stomach has four coats. The tympanum is really a drum. The human skull contains thirty bones. Each hair has two oil glands at its base. The sense of touch is duller on the back. The lower limbs contain thirty bones each. The lobe of the eye is moved by six muscles. The wrist contains eight bones, the palm five, the finger fourteen. Vallejo, Cal.

RICHARD A. SMITH.

Paying Apprentices While at School

To the Editor of the SCIENTIFIC AMERICAN:

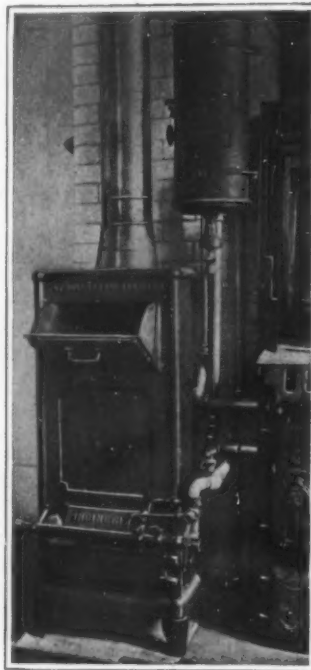
The following might be of interest in addition to the article, "Welfare Work in Germany," in your issue of March 2nd, 1912. One of the largest machine factories in Switzerland (Maschinen Fabrik Oelikon) pays its apprentices for the hours they pass at the industrial school, according to their merit. If their average mark is 6, they receive 15 per cent more pay than usual.

5.9.....	14 per cent.
5.8.....	13 per cent.
5.7.....	12 per cent.
5.6.....	11 per cent.
5.5.....	10 per cent.
4.5—5.5	their usual pay.
4.0—4.5.....	10 per cent less.
1.0—4.0	nothing at all.

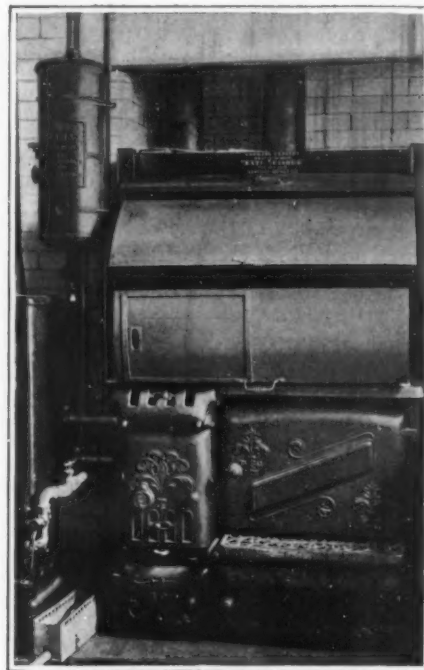
Six is the best mark, and 1 the lowest. The apprentices are given time to attend school ten hours a week. Zürich, Switzerland. CRYMA REITER.



A motor on an adjustable stool mounted on castors may be connected to different devices clamped to the table. A step pulley provides variable speed.



Garbage may be reduced to ashes in an incinerator at little cost and with no disagreeable odors.



An iron hood which may be swung down over the top of the coal range will retain the heat, economize coal and keep the kitchen cool.

Domestic Engineering

The Housekeeping Experiment Station at Colonia, N. J.

By Mary Pattison

SCIENTIFIC management, as recently developed in man's field of interests, has roused the thought of the American woman to question whether this be not a system equally adaptable to her domain.

The purpose of this article is to show that not only are these same principles translatable to her world of activity, but that in the present status of the home, the only sure progress toward the solution of the so-called "Servant Problem," and the high cost of living, is through the gateway of a domestic adaptation of efficiency engineering.

The Housekeeping Experiment Station of the New Jersey Federation of Women's Clubs was organized to develop a practical plan of facing collectively the conditions daily brought to our door by the conflict of capital and labor; a plan that says: Meet the capital problem by organizing the consumer to a better co-operation with the producer and eliminate the servant problem by eliminating the servant class. This latter is not so radical as it at first appears, for the female house-servant is fast eliminating herself. Her tendency is to go to the factory, shop, office or any industry where she can count upon a measure of legitimate freedom, regulated hours of work and her own home for recreation; for she wants that feeling of self-respect which is difficult to obtain in a position where the condition of the work and the workers have been relegated by society itself, to the lowest plane claiming respectability. Apparently women employers have no idea of working for a domestic eight-hour labor day here, and the employee is too constantly held to her post to be able successfully to unionize herself. If, however, the supply of house maids were not rapidly diminishing and the demand increasing in both number and quality, the possibility of establishing any very different standards during this generation at least might be questioned, but, like the high cost of living, it has become both an individual and national question, pressing for immediate solution, not only in America, but in other countries of the world.

This is a question for men and women both, in which women must take the initiative, but men must provide the means for adoption. With the help of man and his methods, we can point to the establishment even now of a new kind of home operation, higher in value and lower in cost, which will include the domestic engineer, together with the expert, or professional worker. The scientific pressure of home subjects makes it imperative to have intelligence at the post. Any high standard in household machinery even, is out of the question except among trained and educated workers, and these it is impossible to call upon until society demands them and makes way for them by breaking up a class, unrelated to any high interpretation of our needs, a foreign element in more senses than one, that together with the conditions about the work and our attitude toward it has nearly torn the home

asunder, making hopeless dependents of both employer and employee. That there are exceptions, we know. There are also many house servants fit to pass almost directly into a professional class; yet the unfit unquestionably predominate. Therefore the thing to be done is to set up a system of domestic independence, or emancipation from this class effect. This women can do in two ways: First, by realizing the subject has a future worthy the highest educational consideration, and giving herself to it intellectually by scientific study of home economics in relation to her own home and the home of the social whole. Second, by taking hold of the actual housework and proving as we have under the Station's method that it not only can be done without servants in many cases where it now seems impossible, but that, shorn of its abuses, has within it every cultural value known in life. The time has come when it must be raised from its commonplace plane not by sentiment but by science, and by doing away with drudgery as an accepted necessity, the long hours of labor, and constant contact with unpleasant and degenerating dirt. These things have already, even in the Station's short existence, been reduced to a minimum.

We went about it in this way: In order to determine just what were the immediate problems of the housekeeper, thousands of questions were sent among the New Jersey club women. For these answers we proceeded, after classifying them, to find the solutions. The most general complaint was ill health and lack of strength. Next, lack of time to cover demands, and, looming large in the foreground, the general lack of means, money for improvements, and the right kind of maids. From these conditions we formed our system of tests and experiments, which are proving that machinery in the home is more generally satisfactory than hand labor; that the scientific study of management is the way to make machinery pay, and that a serious study of one's surroundings and the way to work, is the health solution. Objectively it became a matter of applying the best known machinery, and, through tests in efficiency, economy, time and motion, proving its value in doing the work from both the practical and educational standpoints. Each household operation was reduced to the effect or result desired, and an untiring search made for the best device, tool or material to produce these results. Many household tools on the market have the merit of utility, but most of them lack two elements, beauty of form and proper effect upon the operator. For instance, an individual laundry machine, good in principle and construction, does the work at the expense of the woman's hand. The handle was not made with the idea of fitting the place of strength in the hand and could not well be more uncomfortable. To know the best method of laundering is essential, but as important is the best and highest welfare of the laundress. Again, in ironing, the comfort of the woman

is a serious factor. Why should constant standing be a necessity? And yet, no "sitting" outfit could be found. We were driven to inventing it, to prove our point. Environment is also most important. The beauty and charm of every room has had more attention than the kitchen, where the highest standard of art at present seems to be a place on which one can turn a hose. Beauty includes cleanliness, but should have in addition a quality of constant refreshment and inspiration. A careful study of this point has been made in our scheme of tone color, because we believe it essential to right living.

Food, its preparation, and the manner of cooking has absorbed much of our time, reducing to simplified form the principles of dietetics, which demands the food elements in natural, pure state, and a knowledge of where these may be purchased. The use of electric power in much of the preparation, we find most practical, and cooking with the wonderful fireless-cooker principle, as applied to gas and electric stoves, the latter, clean, automatic, self starting and self stopping, eliminate attention while the process is going on, and conserve both quality and quantity. With very little alteration in shape, this device might grace any dining room, if necessary. The dining-room we found the hardest problem—to give a dinner without a butler or maid. Again we were driven to inventing our own method, which includes a revolving table center, and a "dumb-butler" standing at the left of the hostess. In this manner a formal meal may be served, the table cleared, and with the aid of a surgeon's sterilizing pan, the silver and glass washed. No one need rise from start to finish. A practical dish-washing machine seems to be impossible to find, so that until one be invented we have had to suggest the partial use of paper dishes, which may be burned in the incinerator, in order to carry out our plan of actual domestic independence.

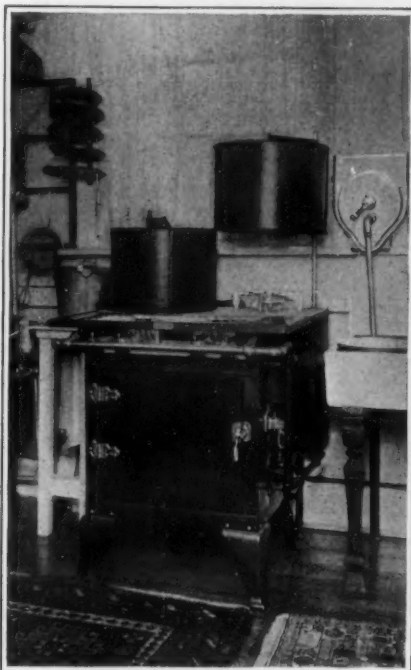
All sorts of experiments in methods of house-cleaning with the best tools known have been subjects of tests, to reduce dirt, and the time required to keep clean. Much of such work might be done from outside, but as it is now in the house we have taken conditions as they exist. Of course we believe and encourage as much being done out of the house co-operatively as is safe and will advance the privacy and individuality of the home. Personal, isolated, and eccentric standards do not make for general progress. There is a best way known of doing everything and that should rule; not necessarily the traditional, or that order of "do as I bid you because I bid you;" rather the one of knowing both the material and the best way, that a proper plan may be made accordingly.

The domestic engineer follows close in the wake of domestic independence, and is nearly related; a new profession to which the old idea of housekeeper must give way ere long. Everywhere we are impressed with

the importance of the study of economics. Do we realize the origin of this word is the science of household affairs? And that it will never reach its maximum usefulness until it has first put the house in order? Scientific management includes efficiency in production, economy in operation, and as a system is effectively applicable not only to the home with no employee, but to the individual who cares to organize herself. We all believe in the policy of conservation. Scientific management is its only technique. We must therefore master these principles and apply them to our daily tasks if we would wisely conserve, to use, not abuse, our natural resources. Now what are these principles? And how may they be applied to home-making, starting with a premise of no employee when the originators of the system declare at least one hundred employees necessary to make a project worthy the efficiency engineer? At the experiment station we have applied the method most successfully, and we believe it fitted to the home in general. Domestic means pertaining to the home and the family. Engineer means the skillful guidance of an enterprise to a desired result, with knowledge of the parts. Efficiency is the elimination of all waste, and the power to produce the effect intended—active, competent power. Science is the best known way, and management means to guide, not force. Surely so far this all applies to the household. The four fundamental principles underlying scientific management are: First, the scientific way of doing everything. Second, the scientific selection of the workman. Third, the scientific training of the workman. Fourth, the co-operation of both parts, the head taking all responsibility of planning; the workman doing the work in a way that will advance his ability and general prosperity. Again it stands for a large day's output, the best conditions under which to work, loss in case of failure, and reward in success. It asks at the outset, what of your material and resources? And what do you wish to produce? Not only do we find the home employee less, but also with no tangible or material product to be turned out at the end of each day, or each week. To be sure we have the preparation and distribution of food, the washing of garments, or the laundry, and the labor needed in cleaning, sewing, nursing, and serving, but no stated output of commodities. And yet we can readily appreciate there is a scientific way of doing every part of housework, and that we can, as intelligent beings, select that part of ourselves which is adapted to the thing we must do, and be trained to the proper doing, guiding our intellect to find the best way, and our instinct to follow as an intelligent co-worker, using what we call the What, Why, and How system, which very soon will become the whole being. Art is the creation of what ought to be from what is, and properly steps in at this point asking *What* is a home? And what are your conditions with which to produce such a one? Philosophy says, "*Why* produce it?" and proceeds to give the necessary thought or reason for the act, while Science tells *how* it shall be done, so that Art becomes intelligent and skillful in the doing. This is not a difficult operation, but one that should be applied to every act of life, if we would make the most of the individual. Thoughtless action is a waste of one's best power. The hap-hazard rule of thumb, any-old-way doing of things, is disorganizing in the extreme. And while it may seem a tedious method constantly to ask one's self *What, Why and How*, it becomes a most interesting and constructive automatic habit of procedure, building up step by step not only the home, but the character, and that real kind of personality that counts—that thing that makes "the man a hundred times better than his words," or his acts. Let us take the woman who wants to improve herself, or her home, for there are only two requirements in the practical application of scientific management to the home; that of having a home, even ever so humble, and the active and intelligent desire to better it; for it is what the home does to the family and the housework for the worker that is important. The home-maker should first ask herself: *What is a home?* then, *What of her home?* How nearly is her ideal being realized? Next she should look to her resources, all the factors that are within her control with which to create that home. Then, with the right attitude and the right sense of proportion, she will be inspired to search for the right way and the right tools with which to proceed, first, analyzing or reducing every part of the home to its units, and building it up again to suit herself.

What the average normal woman wants is not so much leisure, as health, time for all things needed, and a bit of money ahead as a reward of success. Health is a sure return for the right use of the body. How

many housekeepers know just the right movements of the body for all action? Even in the simplest household act there are involved three motives in every movement which work to the good, or otherwise, as we will: First, the one of directly accomplishing, eliminating all useless and fatiguing motions; second, the one of exhilaration, or the building up motive—eliminating all misuse of the spine, the diaphragm, and the muscles; and third, the one of beauty, the sense of touch, which makes for grace and quality in movement, elimin-



An insulated cover closed over the food after it has started cooking, continues the operation, on the fireless cooker principle, after automatically cutting off the gas.

inating awkward, angular, and coarse motions. So that we find a whole world of interest in just "Motion study," as applied to the necessary acts about the house. In fact, if all one's movements were perfect, it would about include the whole of scientific management; just as to keep even one of the commandments in the highest way would of necessity include the keeping of the other nine. With perfected motion, time would be gained. It is proverbial that the big and busy man is the one never hurried. He has not only learned how to work, but is able to apply his *art* instinct to the form and proportion of his work, giving



A glimpse at the tiny dining-room of the experiment station. A variety of electric cooking devices provide for preparing much of the food at the table.

THE HOUSEKEEPING EXPERIMENT STATION

each part its due consideration, and if he is a good business man, he will not overdraw upon his capital of nerve power for every day use and abuse any more than he would upon his bank account.

Money ahead is a result of proper production and proper investment which applies just as surely to the home. One should never invest in anything useful or ornamental until it is incorporated in one's needs, and every possession should pay for itself in one way or another. While labor saving devices are not safe in the hands of the average servant, the average mistress

has yet much to learn of their true value. Too many worthless devices are purchased by the ignorant homemaker, which result in lowering the standard of all home devices. There are good and bad, and there should not only be judgment used in purchasing, but the housekeeper should know the construction, even to taking the machine apart and studying the principle upon which it operates.

There should be an impartial testing place for house equipment and food where a housekeeper may be properly advised as to values. This has been one of the efforts of the Station for the past year, and it has been a satisfaction to find that not only is the best machinery, when really needed, an economic investment, but in every case where conditions are right, it pays a big dividend, a higher interest than would be considered legitimate in stocks. The best electric washing machine, for instance, when needed, will pay a return of 80 per cent of its cost the first year. So with all good labor-saving devices in proportion. The labor to operate them may be more expensive per hour, but one needs less of it. A centralized corporation, or bureau of labor, should be able to supply the home with all the expert workers needed, by the hour, or day, contracts being made by the head and the employer, and not with each workman. This would eliminate the servant in the house and all the expenses attendant upon her, and there are many, and give us a class of independent, self-respecting business people, both men and women, for housework positions. This is not beyond the possibility of the near future, but in any case the present necessity is to standardize the home through the system of domestic engineering, or scientific management, so that there may be a perfect co-operation of the family in efficiency principles, the *What, Why and How* method, as worked out in the following principles: The object, purpose, or "ideal" of the home; "common-sense and judgment" in procedure; "competent counsel," or the finding out of just *how* to do things; "the fair deal" for everybody concerned; to live and let live in freedom; enough "discipline" to make each want to do his share; "accurate, reliable and immediate records," that proper conclusions may be arrived at; "planning and dispatching," that indecision and that weakness which is the result of nervously planning as you go, be avoided; knowledge of "standard conditions" in all things and "standard operations," but one's own "standards" of practice and "schedules" of procedure which make for originality and individuality in production; the writing down of all things that may become valuable as "instruction;" and finally the very large principle of "Efficiency Reward," or the proper appreciation of all honest effort, and the condemnation of the dishonest. This system as outlined by Mr. Emerson, we believe, is applicable to all procedure, and could readily be made the family parlance. It practically means the whole of the man in every act; the whole of the family to create and maintain the home, and is by

its very nature of elimination a work-simplifying method whereby we may successfully face the serious problem of labor and capital in the home, preserving within its functions the private and individual joys of the home group, and home ideals.

The essentials of a home are few, but they are exceedingly fine! Housework should and can—instead of being a drudgery that wears out the woman—be an occupation that will demand her highest conception and highest powers of production, thereby contributing to her highest powers for culture; a self-realization and a self-determined doing that will make for the development of her best personality. In the last analysis there are but two instincts that diverge from the great consciousness, the one, home-making; the other, world-conquering; and as the highest object of the second is but to deposit the results at the shrine of the first, what we call Home is supreme, and as such does it not demand conservatism, and is it not worthy our highest combined consideration?

Launching of the "Queen Mary."

THE British dreadnought cruiser "Queen Mary," which belongs to an improved "Lion" class, was launched on the 20th of March. The vessel has a normal displacement of 28,850 tons, as against 25,000 tons of the "Lion," and the horsepower of the engines is 80,000, as against 70,000 of those of the "Lion." This makes the "Queen Mary" the largest vessel in Great Britain's navy. She will carry eight 13.5-inch guns. The contract speed of the "Lion" was 28 knots, but on her trial she made 31 knots. It is expected that the "Queen Mary" will show a greater speed. The cost of the vessel amounts to \$10,305,320.

The Private Sewage Disposal Plant

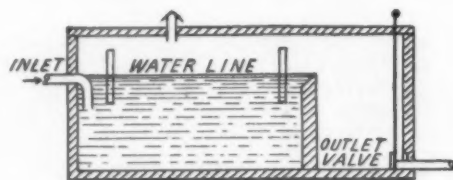
Systems Adapted for the Detached Villa, Farm or Country House

By Dr. Jacolyn Van Vliet Manning

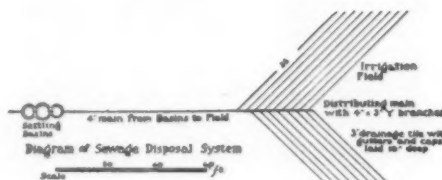
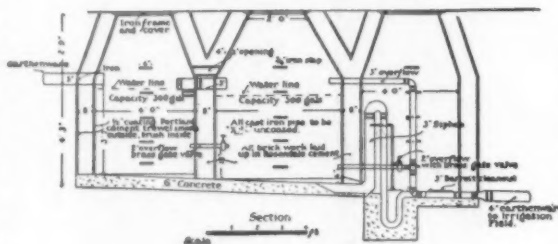
THE windfalls of the orchard decompose and fertilize the coming harvest; the body of a dead animal liquefies and nourishes the herbage upon which it fell; both fruit and fauna have been acted upon by multitudes of destructive bacteria whose *tour de force* is the transformation of animal waste into soluble plant life. Such are Mother Nature's own scientific methods of disposal of waste, and man cannot do better than follow them. The danger of obsolete methods of sewage disposal are definite, and now well known. The open privy in town or country remains a breeding place for house-flies that transmit fecal deposits directly to the pantry, dairy, and table; this primitive latrine when situated on a hillside, also drains directly to the nearest spring or brook, and is the convicted agent which not infrequently initiates an epidemic of typhoid fever in a nearby community. The leaching cess-pool is an immediate menace to the household well; contamination may not occur for a period of years, but there is no way of ascertaining when such seepage is established. The privy vault is rarely water-tight when constructed, and sooner or later becomes pervious.

The new process of sewage disposal consists in summoning the aid of destructive bacteria, which, under favorable conditions, have proved faithful workers, rendering effete material into food with which to build up a vineyard or bud the rose tree. There are two distinct families of these scavengers, which demand different environments. The first liquefactive bacteria become active only when oxygen is excluded, and this characteristic determined the name by which they are known, namely, anaerobic germs, or germs living without air. The second class of willing workers, known as aerobic germs, demand quantities of oxygen, supplied to the medium they are converting; the more thorough the aeration, the more quickly is their part of the task accomplished. Anaerobic germs develop with great rapidity in sewage confined in a tank from which the atmospheric air has been excluded. Their action results in liquefaction and disintegration of the sewage, during which process various gases are liberated and held in solution, and complex structures are broken down to elements capable of recombining in the growth of vegetation.

Fortunately, water under pressure is available in most country houses, making possible the water transportation of excreta. In the disposal of this sewage, the first step is the construction of a tank in which this bacteriological process of reduction may take place, and the specially contrived sewage receptacle is therefore called the reduction tank, or in somewhat more striking language, the septic



Section of septic tank with valve.



From "Sanitary Water Supply and Sewage Disposal of Country Houses," D. Van Nostrand Co.

Economically built sewage disposal plant and sub-surface irrigating system.

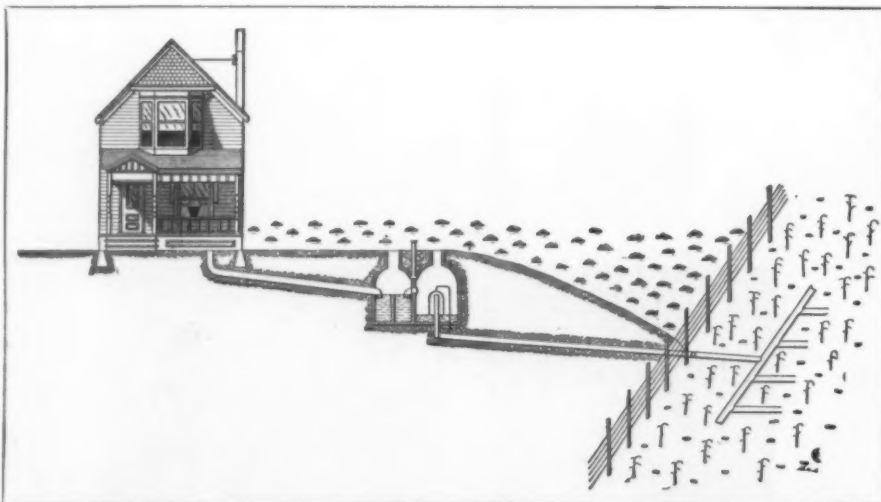
tank. The process of reduction is forwarded by permitting little disturbance of the contents of the tank while such digestion is advancing, and this is achieved by the use of one of two modifications: (1) Baffle boards placed before inlet and outlet pipes, which check motion acquired by flowage; (2) division of chamber into a larger and smaller compartment. As the contents of a pint bowl may be divided by placing a small cup in the bowl, so the septic tank may be divided by the addition of a half-high partition. With such partition, the small chamber receiving the fresh accessions of sewage, there will be a more or less constant overflow into the larger chamber, which is known as the settling basin.

After a varying degree of time in the septic tank the sewage is disintegrated and liquefied; disengaged scum floats on the surface and the precipitation of all remaining solids takes place. Through an outlet pipe submerged below the water line, the liquid contents may flow or be siphoned away. This effluent, without farther treatment, is an enormously valuable plant food, or fertilizer, and wherever possible should be dispersed to the land by surface or sub-surface application. I am informed by a recently returned traveler that in thrifty Japan no one portion of such valuable land-food is wasted. All dejecta is returned to the arable land of the country, tall blue vases of earthenware being universally used for storage and carriage. If the return to the land of this valuable liquid manure is barred, it must be rendered innocuous to humanity by more extended treatment and may then be permitted with safety to drain into a sewer or waterway. The purification of the effluent may be attained by: (a) Intermittent filtration, through sand, gravel, coke, etc. (mechanical); (b) treatment on contact bed (mechanical and bacteriological). In the second method, treatment on the contact bed, the trickling sewage is exposed on well aerated gravel, to the action of oxygen, and the aerobic bacteria.

These systems of purification are expensive in installation and maintenance, and should be used only by municipalities, manufacturing plants, and institutions, which have no access to arable lands.

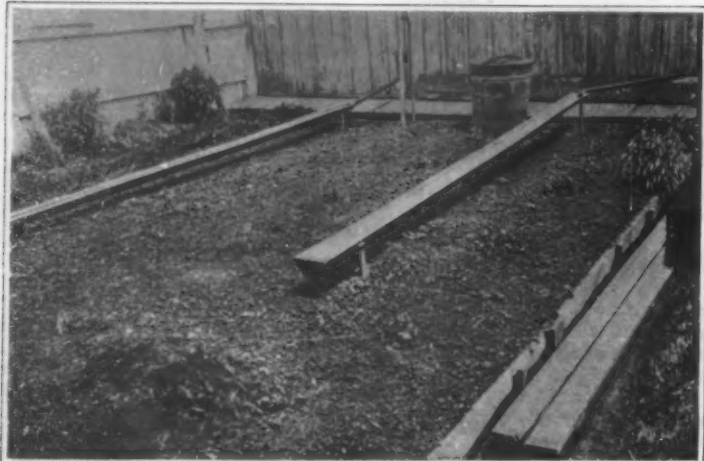
The farm and country house with more than an acre of ground attached should board and distribute to the land the effluent of the reduction tank. The detached villa with less than an acre of ground, usually makes one in a small community of homes, which could inaugurate a community disposal plant for mutual benefit. When the land consists of only a single village lot, and there is no water system, the contents of the slop-hopper and the earth

(Continued on page 342.)

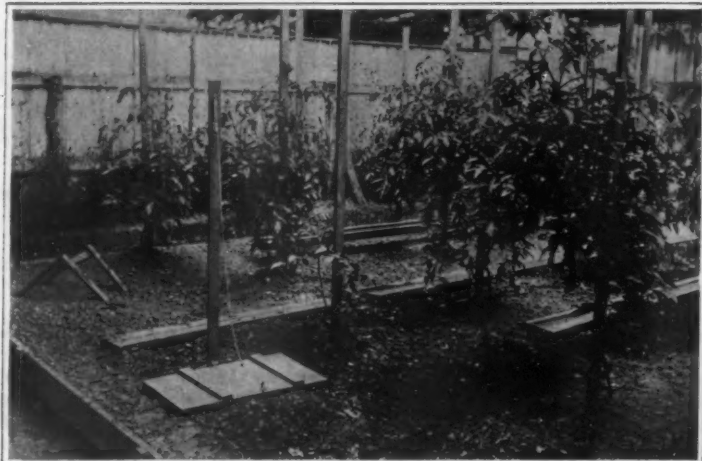


Courtesy of Dr. Harvey B. Babson.

Septic tank with automatic siphon installed on the lawn of a bungalow.



System of troughs for distributing liquid sewage.



Garden fed from a private sewage plant.

THE PRIVATE SEWAGE DISPOSAL PLANT

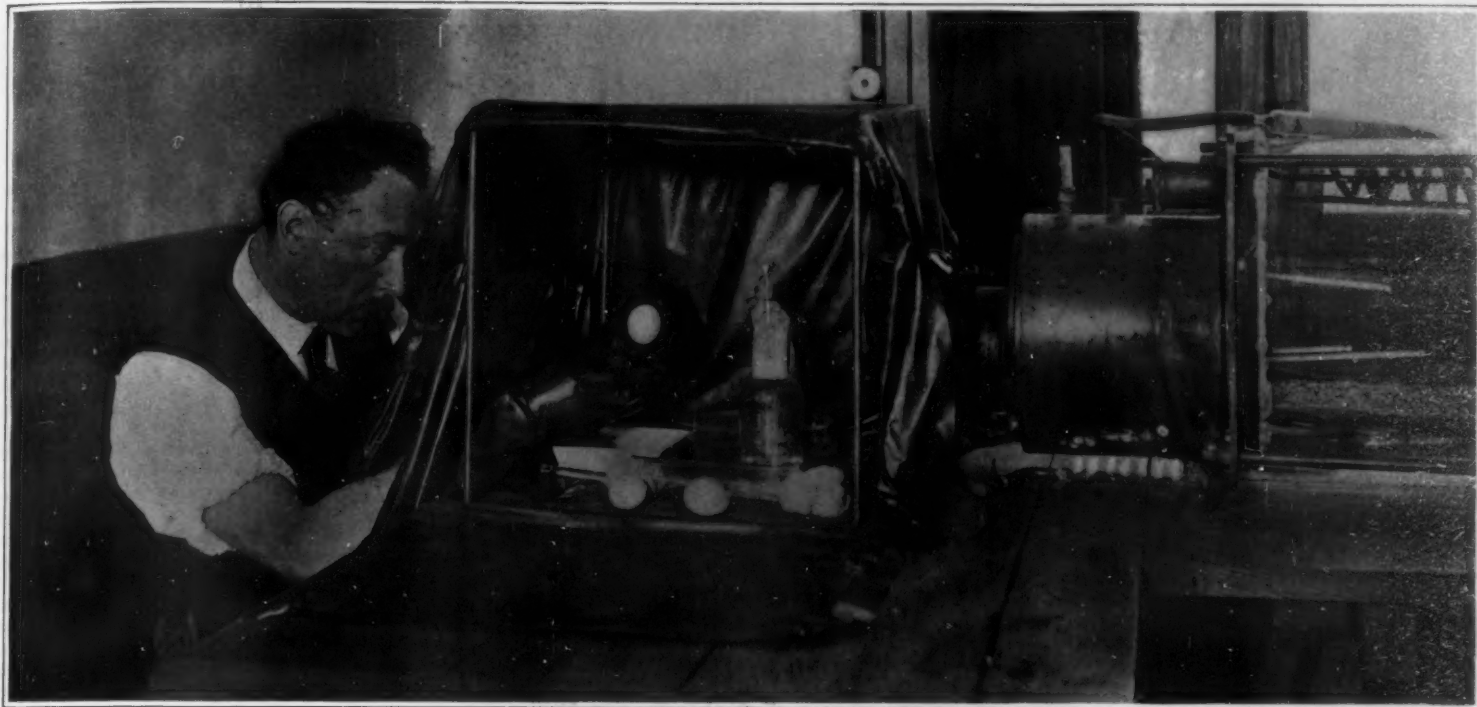


Fig. 1.—To show the method of manipulation one side of the ante chamber was removed before the photograph was taken.

Life Without Bacteria

The Remarkable Experiments of Dr. Michael Cohendy

FOLLOWING closely the improvements in the methods for the study of micro-organisms by Cohn, Pasteur, DeBary, Lister, and others, the discovery was made that in the intestines of most animals many kinds of bacteria are normally present. Further study showed that in some animals, especially certain worms, caterpillars and other forms without back-bones, bacteria were rarely or never found, whereas in certain vertebrate animals they were always present. This constant association between the bacteria and the higher animals led Pasteur and others to the conclusion that there must be some advantage to the animal that harbors the micro-organisms; in other words, the notion became current that there is a mutual benefit association between the bacteria and their hosts. In many of the older text books it is possible to find the statement that digestion depends to a degree upon the presence of the bacteria in the intestines.

The earlier attempts to rear animals from eggs without allowing bacteria to enter were unsuccessful; from these it was impossible to draw any conclusion as to whether the presence of the bacteria in the intestines is or is not essential to the life of the higher "partner." There seems to be no regular connection between the character of an animal's food and the presence or the character of the bacteria. Thus the dog and the cat, which feed on animal food, have as rich a bacterial population in their intestines as have the herbivorous sheep and cow; the crayfish, which feeds on decaying organic matter rich in bacteria, the larva of the clothes moth, even when living in a carpet teeming with bacterial life, various worms living as parasites in the intestines of man and other animals—all are found to be nearly or quite free from bacterial inhabitants in their alimentary canals.

In spite of the absence of positive evidence on the subject, Metchnikoff came to hold definite views to the effect that the bacteria in the food tube of higher animals were *not* generally of benefit to the host. His conclusions rest largely on the correlation between a rich intestinal flora and the shortness of life. Whereas longevity of species of animals varies in general with the size of the body, he notes that certain large birds, like the ostrich, the rhea and the cassowary, which have many bacteria in the intestines, do not live as long as other species of smaller birds, like

the eagle, falcon, etc., which have not so many bacteria in the intestine. These views are closely connected with Metchnikoff's theory of immunity from disease and the prolongation of life.

In a series of experiments started nearly twenty years ago by Nuttall and Thierfelder, guinea pigs were reared under conditions that excluded all bacterial life. The experimental animals grew and prospered as well

as those under ordinary conditions. From this it may be concluded that bacteria are not essential to the lives of these animals. It has also been pointed out that many arctic animals have no bacteria in their intestines, whereas related forms in temperate or tropical regions, with bacteria, are no better off, and no worse off. In 1902 Schottellus attempted to raise chickens from sterilized eggs; the chicks were supplied with sterilized food brought to them with great precautions against possible infection. In spite of all precautions, however, it was found that bacteria did get in at some point; and at any rate, these experimental animals did not thrive so well as those raised under normal conditions. The chicks hatched from the sterilized eggs and kept in the sterilized room lost weight after a while, unless they were fed with ordinary food.

Later Dr. Michel Cohendy, a Frenchman, went to Freiburg-im-Breisgau to undertake similar experiments in Schottellus's laboratory. Here he repeated the master's earlier experiments, but with different results. The chicks hatched from sterilized eggs, reared in surroundings free from bacteria and fed on sterilized food, grew as well as those hatched and raised under ordinary conditions. The bacteria neither helped nor hindered the development. As a check upon the microbe-free conditions of the experiment, Dr. Cohendy later placed the wings, legs, excrements, etc., of the chicks in culture media; these gelatine cultures showed no bacterial growth.

In order to confirm these results, Dr. Cohendy, upon his return to France, decided to repeat the experiments under the conditions that would leave absolutely no room for doubt as to the significance of the results; since the technical difficulties imposed by the problem make absolute certainty almost unattainable. With the aid of M. Laqueux he constructed an apparatus consisting of a rather large cylinder of glass connected with a copper chamber and having a metallic platform with raised edges to take the place of the ground. The copper chamber which serves as an incubator, is ten inches long and 10 inches in diameter, while the glass "poultry-yard" is 14 inches in diameter and 32 inches long. In this breeding chamber the chicks are supplied with sand, a continuous current of fresh,

(Continued on page 885.)

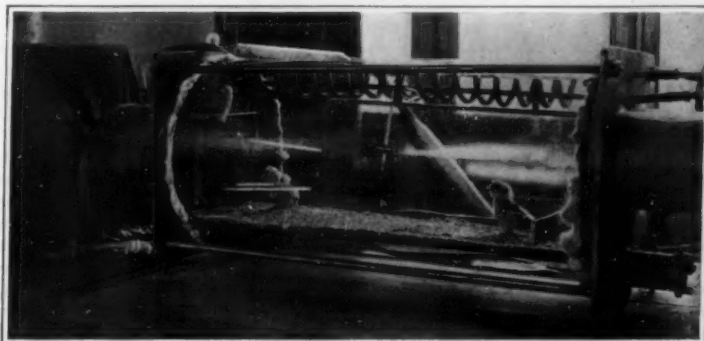


Fig. 2.—Within a few hours after breaking through their shells the chicks leave the incubator and the next day they run about, peck at food and drink from their trough.

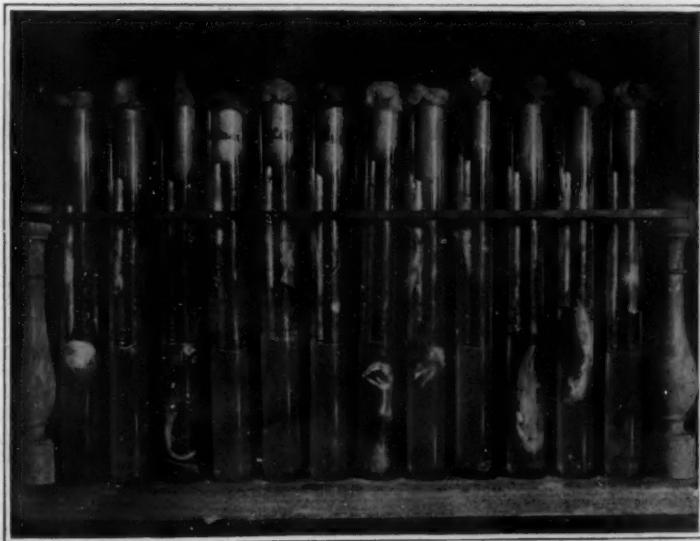


Fig. 3.—The bodies of the chicks are placed in sterilized flasks. They are subsequently dismembered, the different parts being placed in many tubes containing various culture media in order to propagate whatever bacteria are present.

Arrhenius and His Electrified Children

A New Use for High-frequency Currents

By John B. Huber, A.M., M.D.

IT is reported in the daily press that Prof. Svante Arrhenius, the noted physicist and Nobel prize winner, has completed in Stockholm a series of experiments proving that the electrical high-frequency current is a marvelous aid to the physical and mental development of school children, "nearly doubling their growth and greatly improving their learning." We are informed that two groups of children of practically similar age, physique and mentality were placed in two rooms precisely alike, except that in one were wires carrying high-frequency, alternating currents made known by d'Arsonval. Neither the teachers nor the pupils, it is reported, were aware of their exposure to the "magnetic influence."

At the end of six months, runs the report, the electrically charged children had grown an average of 51 millimeters (2 inches); while the children not thus charged averaged in growth 31 millimeters (1.16 inches). As to psychism, taking twenty as the standard of perfection, the magnetized children reached in their studies an average of 18.4, while fifteen attained a perfect mark. On the other hand, the unmagnetized children reached an average of 15, only nine attaining perfect marks. It would seem also that length of days is to be assured these fortunately electrified children; and the newspaper here referred to begins with impressive quotations from Scripture as to living forever and otherwise more or less relevant to this assurance. The magnetized teachers are said to have attested that their faculties were quickened and their powers of endurance increased. "The experiments undoubtedly will be enlarged; and if the results are verified it is thought that the system will be adopted immediately to aid backward children."

The reflecting scientist may well be skeptical as to the accuracy of these reports. As they stand one may, however, consider them from two viewpoints: That of our present knowledge of the effects of the high-frequency current, and from the biologist's point of view.

High-frequency currents are oscillating condenser-discharge currents, having a rapid rate of alternation, up even to millions per second. These currents are produced usually by the discharge of a condenser, such as a Leyden jar, through a small inductorium in the circuit. The static induced current was discovered by Dr. William J. Morton in 1881, and other workers have since made modifications and have invented appliances by which the therapeutic value of these currents has been enhanced. There are the high-frequency d'Arsonval oscillator; Tesla's transformer, which Piffard adapted for the treatment of disease; Oudin's resonator, and so forth.

One is apt to think of the living body (especially his own) as an isolated entity, a something quite distinct from its environment. But this is not absolutely so. The body is anyway nine-tenths water. And it is possible that the electric waves generated by the high-frequency current may materially though intangibly affect the many millions of cells which make up any individual corporeal life. A species of "molecular gymnastics" is considered to be induced by the infinitely rapid oscillations between plus and minus electricity or a sort of molecular torsion and recovery induced by alternating charges. Thus, it may be claimed, indeed considered even proven, that high frequency currents have had distinctly physiological effects. D'Arsonval has undoubtedly produced salutary modifications of metabolism by means of high-frequency, high potential currents. And some of the effects produced by him and by others have been unquestionably remedial. In d'Arsonval's experiments more water was given off by the body and more carbonic acid, the ratio in patient and animal being ten, twenty, even thirty per cent. Excess of uric acid is brought down to the normal by excretion, and elimination is markedly furthered.

It may be assumed, then, that

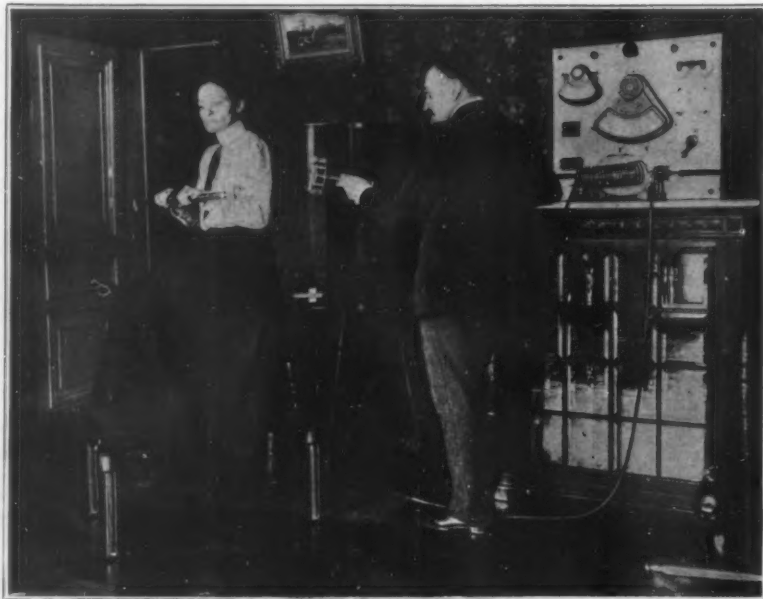
metabolism (that process by which oxygen and food-stuffs are converted into bodily tissue) is affected by the d'Arsonval current; and that a faulty metabolism may be corrected through the elimination brought about by this current and in other ways not as yet perfectly comprehended. So that in a number of diseased states—in "disorders of metabolism," in certain skin lesions, in some nervous disorders, in malignant



An apparatus for the reduction of arterial pressure by means of high-frequency currents.

growths, in diabetes, gout, rheumatism, arteriosclerosis and so forth—the high frequency current is an "indicated" measure. But note, with regard to the matter now in hand, three undoubted effects of its application: In the treatment of tuberculosis at least the high-frequency current has been found to decrease the weight and to increase the bodily temperature, and this current tends to eliminate phosphorus.

How, then, in the first place, has it come that those Stockholm children have increased in weight (whereas the physiological action of this current seems to be to decrease weight, which it must certainly do if its effect is for elimination)? And were it not unwise to raise a bodily temperature unduly, is it not possible to overdo oxidation? Instead of having, by such unnatural means, a body "live forever" (or a century anyway), is it not possible by such inflammatory process to burn out the body prematurely? Is it likely that no penalty is to be paid for such unnatural stimulation?



Application of high-frequency currents in the form of electric spray in cases of excessive arterial pressure.

And how would the biologist consider the electrification of children?

In all ages humankind has entertained without variation certain fundamental ideas; differences regarding these ideas have been only in nomenclature. When the world was young the three Fates were spoken of. The three modern Fates, fully as inexorable as those of mythology, are heredity, environment, and function.

And now, as ever, this is bestowed upon humankind the saving gift of will by which, so long as man respects the fates, he may be a coefficient in the working out of his own destiny. Only that will is normal which realizes its limitations and understands that if it is to be effective it must co-operate with rather than flaunt the Fates. Heredity, environment and function work even in most intimate interrelation; that will were indeed vast which would undertake to disturb such harmony.

Heredity is not easily modified; its manifestations are the result of the working of natural laws through many generations; any experimentation by which it were planned to effect a radical change in its phenomena were most ill advised.

Environment presents the external relations to which the body's internal relations (its functioning) must be rightly adjusted, if there is to be normal living. It were abnormal indeed, and nowise conformable with natural processes to force children for a few hours in the twenty-four into such a man-made environment as that in which electric waves of high frequency and high potency are generated. Here were an exhibition of perverted will snapping its fingers in the face of fate and as certainly inviting Promethean disaster.

We have seen how function is meddled with by this use of electricity. How careful should we be in employing this force, the essential nature of which we comprehend hardly at all, not much better to-day than did Volta and Galvani. In their day it was imagined the secret of the origin of life had been found, and men spoke of the vital principle and the spark of life. But these terms were after all really explanatory of nothing.

We know electricity only by its behavior, which is oftentimes terribly destructive. It may, in our present knowledge of it, affect the human economy in a way altogether unfortunate. Electrifying children were a perversion quite akin to the foolishness of "doping" normal individuals by the inhalation of pure oxygen, which gas is appropriate for the healthy only in its mixture with nitrogen as the environing atmosphere to which living creatures have throughout the ages become accustomed.

What is desirable for us is creatures (men and women and children) natural to our era. Monstrosities and giants and mastodons and ichthyosaurs were very well in the geological age to which they were conditioned. Possibly, on the other hand, future aeons will present conditions appropriate for the evolution of supermen and superwomen; but this will come to pass not in months or in years, but only in many thousands of years. Even the noble science of eugenics cannot force the process.

Wells has written a story, "The Food of the Gods." By means of this food babies were nourished to the degree that developed into giants the height of trees; they were most unhappy because there were no houses properly proportioned for them to live in, no beds they could rest in, and so forth. Some rats managed to get hold of this food and grew enormously. Rats are unpleasant enough as it is—but rats the size of sheep! Some wasps also inbibed this food, and became the size of Easter hats! A most unpleasant state of things developed; the only solution of the difficulty was a return to natural conditions.

This parable teaches us that every interference with nature causes not only the looked for effects, but also others, full of dangerous possibilities.

The Real Fata Morgana

What Is Known To-day About the Famous Phantoms of the Calabrian Coast

By C. Fitzhugh Talman

“WHEN the rising sun shines from that point whence its incident ray forms an angle of about 45 degrees on the sea of Reggio, and the bright surface of the water in the bay is not disturbed either by the wind or the current, the spectator being placed on an eminence of the city, with his back to the sun and his face to the sea—on a sudden he sees appear in the water, as in a catoptric theater, various multiplied objects, such as numberless series of pilasters, arches, castles well delineated, regular columns, lofty towers, superb palaces with balconies and windows, extended alleys of trees, delightful plains with herds and flocks, armies of men on foot and horseback, and many other strange figures, all in their natural colors and proper action, and passing rapidly in succession along the surface of the sea, during the whole short period of time that the above-mentioned causes remain. But if, in addition to the circumstances before described, the atmosphere be highly impregnated with vapor and exhalations not dispersed by the wind nor rarefied by the sun, it then happens that in this vapor, as in a curtain extended along the channel to the height of about thirty palms and nearly down to the sea, the observer will behold the scene of the same objects not only reflected from the surface of the sea, but likewise in the air, though not in so distinct and defined a manner as in the sea. And again, if the air be slightly hazy and opaque, and at the same time dewy and adapted to form the iris, then the objects will appear only at the surface of the sea, but they will be all vividly colored or fringed with red, green, blue, and the other prismatic colors.”

So runs the classical description of the Fata Morgana, written in 1773 by the Dominican friar, Antonio Minasi, and since become the common property of encyclopedists the world over.

Minasi was born not far from Reggio, and saw the Fata Morgana himself three times. His description is probably, in the main, accurate, though, as we shall presently see, he limits the time of occurrence of the phenomenon too narrowly in stating that the sun must be at an altitude of about 45 degrees. He was the first writer to point out that the Fata Morgana occurs in two distinct varieties; viz., the *marine Morgana*, which appears to lie in or beneath the water, and the *aerial Morgana*, which extends upward to a considerably greater apparent altitude. Minasi's third variety, the *iridescent Morgana*, appears not to have been observed since his time. The atmospheric refractions to which the Fata Morgana, in common with other forms of mirage, is due are not usually attended with a sensible dispersion of light (i. e., separation of the prismatic colors), but that such dispersion may sometimes occur is by no means impossible. In fact, we shall have occasion



Fig. 1.—The streak of white mist that usually ushers in the Fata Morgana. Sketch by Dr. Boccara.



Fig. 2.—The Fata Morgana fully developed. After Dr. Boccara.

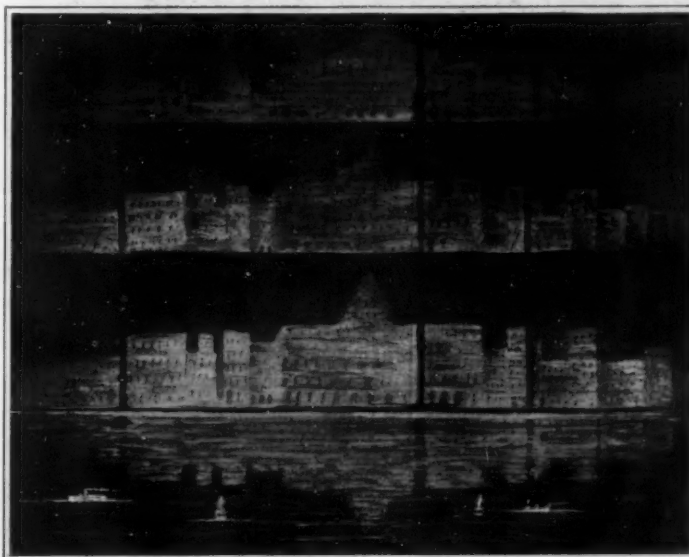


Fig. 3.—A multiple Morgana, according to Dr. Boccara.

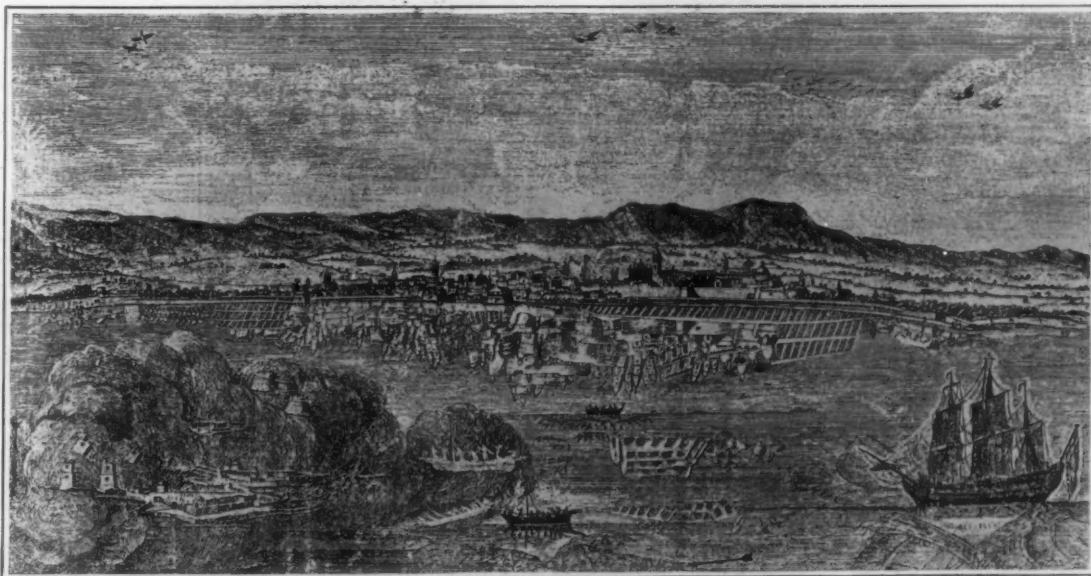


Fig. 4.—Minasi's representation of the Fata Morgana.

The city in the background is Reggio, but this is a license on the part of the artist; the Morgana is always seen in the opposite direction.

later to mention a form of mirage, seen in another part of Italy, in which iridescent coloring is stated to be a common feature.

Minasi's attempts to explain the Fata Morgana are far less happy than his descriptions. In his day little was really known about abnormal refractions in the atmosphere, though he lived upon the eve of the important discoveries of Gruber, Büsch, Monge and Biot. The Straits of Messina are subject to strong tidal currents, which often run in opposite directions at a given time; that is to say, in midchannel the current sets to the north while along shore it is running south, and *vice versa*. Minasi supposed that the surface of the water thus acquired, at times, marked differences of level, so that it behaved like a mirror lying, not horizontal, but tilted at a slight angle, or at several angles in different places, and reflecting objects along the Calabrian shore (i. e., the shore of the Italian mainland, on which Reggio lies). He therefore took the Morgana to be the reflected image of Reggio and the adjoining coast—the same coast from which the phenomenon is seen. In Minasi's picture (Fig. 4), which has been the basis of the greater number of the representations of the Fata Morgana shown in textbooks and reference books, the city in the background is Reggio, while in the foreground are shown all three of the forms of the phenomenon that he has described. It was intended to be a generalized diagram of the Fata Morgana, rather than a faithful picture of its appearance at any one time.

Minasi's explanation is of course no longer accepted, and we now know that the terrestrial objects seen in the Morgana are the refracted images of such objects on the Sicilian coast, or in some cases on parts of the Calabrian coast remote from the place of observation. Moreover, if we except the altogether unconvincing narrative of the French traveler Jean Houel,* there are no cases on record in which the Morgana has been seen from the Sicilian side of the straits.

It is most remarkable that a phenomenon so renowned as the Fata Morgana has been the subject of extremely few accurate scientific investigations conducted on the spot. The rarity of the phenomenon, however, serves in a measure to explain this fact. Many people who have spent their whole lives in and about Reggio have never once seen the famous spectacle.

In our own time only three persons, two of whom lived for some years in Reggio and were eye-witnesses of the phenomenon, have attempted to collect and discuss all the existing information concerning it. Pernter, in his great "Meteorologische Optik," not only publishes the principal descriptions of the Morgana that had appeared up to the year

(Continued on page 345)

* Voyage pittoresque des îles de Sicile etc., 1782-87, tome II, pp. 21-22.

Curiosities of Science and Invention

The Electric Fireless Cooker

ECONOMICAL use of electricity in cooking requires the use of the fireless cooker principle. The electric fireless cooker shown herewith consists of a cabinet which is perfectly insulated against loss of heat. A thermostat turns off the current when a certain degree of heat has been reached, and automatically turns it on again when the temperature falls below a given point. In this way, the housewife can place her dinner in the cabinet to cook and leave it to attend to other duties, with the certainty that it will not burn. The great advantages of electric cooking are well known; it is convenient, does not heat the house in warm weather, and is extremely economical. In appearance the device is far more attractive than the range or gas stove, and of course requires far less cleaning.

A Motor-hauled Threshing Machine

ATRACTION threshing machine has been perfected and constructed by a farmer at Skowhegan, Me. The inventor has taken the ordinary four-wheeled jigger and on one end has placed the separator and at the other end a gasoline engine, which has been common in threshing grain; but heretofore the combination has been hauled from place to place by a pair of horses, incurring considerable expense. With the new combination, the power that threshes the grain carries the machine from place to place. The rear wheels are geared to a drive shaft, which in turn is connected by a belt and pulley to the engine. In moving about from place to place this automobile threshing machine travels at the rate of four miles per hour.

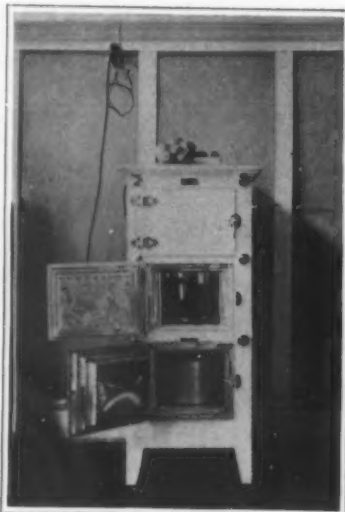
A Mechanical Trumpeter

IN the Deutsches Museum at Munich is a remarkable technological collection of vast historic interest, in which will be found an automatic trumpeter built in 1810 by Friedrich Kaufman. The apparatus, although over a century old, still plays tunes.

The construction and operation are more remarkable for good workmanship than for mechanical ingenuity. A clock mechanism, actuated by weights, drives a drum which is studded with pins, after the fashion of a music box cylinder. Pivoted fingers are actuated by the pins to swing two sets of reeds into operative position. These reeds are located in the head of the model. By means of the mechanism the proper reed is brought into position to permit air to flow past it and out into the trumpet, the air, as it does so, vibrating the reed and producing the musical note desired. The blast of air is obtained from a bellows driven by a motor. The number of pins on the drum will enable the trumpeter to play six tunes.

Dynamiting the Ice at Rochester

THE Genesee River is the only stream crossing the entire State of New York. It rises in Pennsylvania, flows directly north and into Lake Ontario, from which its waters are borne to the sea by the St. Lawrence River. In the spring this river, so modest in summer, rouses apprehensions along hundreds of miles of its course, and nowhere more than in its passage through the city of Rochester. To this day the 200,000 and more inhabitants of this city talk about the great flood of 1865. That historic flood was caused by the breaking of ice gorges in the upper valley, and the letting free of an immense volume of water, which, in the upper part of the city, overflowed the banks, and set loose immense quantities of lumber in yards then existing. This, together with ice and other debris, so blocked the arches of the aqueduct of the Erie canal (seen in the illus-



The electric fireless cooker.



Dynamiting an ice jam at Rochester.



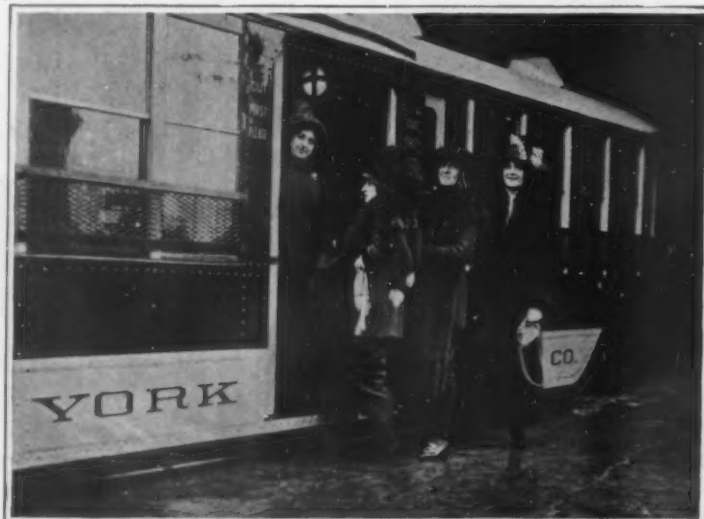
The machine is hauled by the motor that drives the thresher.



An automatic trumpeter built in 1810.



Both these waterwheels, drawn to the same scale, are of 150 horse-power.



New center-door street car. The floor is ten inches above the ground.

tration beyond the nearer arches of the Court Street bridge) that the waters were dammed and overflowed a large section of the city. Great loss followed.

During the present early spring the conditions seemed once more peculiarly threatening, after so hard a winter, and it was deemed necessary to open the channel by dynamiting the long-standing ice. The picture shows two out of a half dozen blasts. Court Street bridge, just below, was thronged with spectators, quite ignorant of the danger to which they were exposed. For huge sections of ice were thrown far skyward and fell where they might, one breaking through the roof of the Erie Railroad train shed, whose tower is seen between the two geysers; another through the roof and into the gymnasium of the police headquarters, located opposite the jail, and yet another on the very front of a baby carriage, in which an infant was being trundled by its parents. Happily, no one was seriously hurt. In the distance, Main Street is built solidly over the river, its arches serving as a second trap to catch ice and logs and prevent free egress of the waters.

The Largest Overshot Waterwheel in the World

THE accompanying illustration is a reproduction of a large drawing which hangs in the Deutsches Museum at Munich. The drawing represents the largest overshot waterwheel in the world, built about 1865 in Laxey, on the east coast of the Isle of Man. Its diameter is 72 feet 2 inches, and it delivers 150 horse-power. In the upper right-hand corner of the illustration is a modern Felton waterwheel of exactly the same horse-power and designed for the same drop and quantity of water. Both motors have been drawn to the same scale.

New Center-door Street Car

A NOVEL form of car having passenger entrances at the center only has been worked out for the electric railways of New York city. By placing the trucks at the extreme ends of the car, a low floor at the entrance doors is provided, ten inches only between doorsill and street pavement, which is hardly greater than the rise between the treads of an ordinary house stairway. From this point the floor slopes upward very gradually toward each end. The motorman's compartment is entirely shut off from the space occupied by passengers. The car wheels and truck frames project up into the space beneath the seats at each end of the car. The conductor's post is directly opposite the pair of center doors, at the most advantageous point to open and close the doors and receive the fares of incoming passengers. The doors are automatically operated by compressed air, by a device similar to that used on the side-door subway cars in New York, which allows the door to be closed while passengers are crowding through it, yet relieves the pressure when the door is blocked by the body of a passenger and automatically applies it again when the obstruction is removed. In this manner the door works its way to a safe closing through a crowd of passengers without causing injury to any of them, yet in a sufficiently positive motion to cause the path of the door to be cleared promptly. If a man's overcoat or a woman's skirt gets caught in the door, the car cannot be started until the object is removed. It will be impossible for the car to start unless the door is closed tight, no matter what position the controller handle is in, and it will be impossible to open the door till the car stops. Ventilation is automatic, the air supply being controlled by a device connected to the car springs so as to admit air in proportion to the weight (that is, to the number) of passengers aboard the car. The electric heating is controlled by a thermostat.

Suggestions for the Workshop

Ingenious Expedients of Resourceful Mechanics

An Automatic Cellar Switch

By J. Edward Hanning.

SOMETIMES the cellar lights are left burning for long periods by the forgetfulness of someone to turn off the switch on coming up. The lights not being visible, the fact that they are burning is not noticed until another descent is made. After having this happen many times, I endeavored to devise a switch that would prevent even the forgetful person from leaving the lights burning.

The result is shown by the accompanying drawing, which explains itself. However, a few notes to make it clearer will not be out of place.

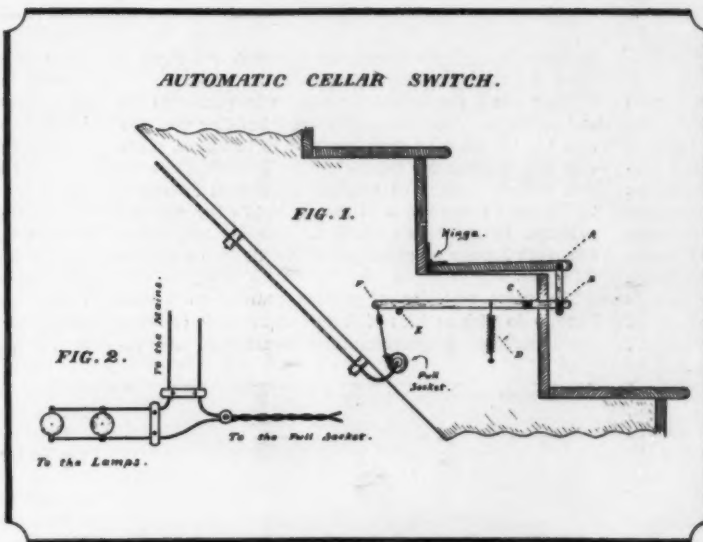
The two levers in Fig. 1 are pivoted at A, B, and C. The distance from C to F should be about six times the distance from C to B. Therefore the movement of the step at A will be increased about six times at F.

The stretched spring D is fastened to the lever and to the side board of the stairs. Its duty is to keep the step raised, by pulling the left end of the long lever down. A screw or nail, E, is put into the side of the stairs to act as a stop for the lever and thus prevent the step from going up too far. The play of the step should be about one-fourth inch.

A pull-socket is firmly fastened to the side of the stairs in the position shown. The chain is fastened to the end of the long lever at F. A fairly stiff spring is inserted in the chain to take up the surplus movement of the lever. The electrical connections are shown in Fig. 2.

If the step is now pressed the chain of the pull-socket is pulled and the lights come on. When the step is pressed again, the lights go off.

With this switch no attention need be given the lights whatever. As a person goes down the stairs, the lights come on, and on coming up, the lights go off. Of course this switch would be unsuitable in a place where more than one person would be going down cellar at a time. But in most houses, the conditions are right for this style of switch.



The forgetful man's self-operating cellar lamp switch.

never result from such a position as is shown in the photograph, indicating the right way to start but the wrong way to continue to use the tool.

The old saying that a poor workman quarrels with his tools has a decided foundation in fact. The poor workman uses dull tools, and no dull wood-working tool ever did a clean job. The poor workman may make every effort to have sharp tools, but just because he is a poor workman, he doesn't know how to sharpen his tools, and succeeds in getting a rounded edge where he wants a sharp one. Yet sharpening a plane or chisel on an oil stone is not a difficult matter, nor one requiring any great skill. It is a matter for a little time, patience and knowledge rather than dexterity. The business part of a chisel or a plane is a wedge, of extreme fineness of edge. Hence it is that the angle

of the chisel and plane blades is of primary importance. That angle is determined for you by the manufacturer. All you have to do is to see that you keep it when using the oil stone, that your hand is steady and your oil plentiful, and that you use enough time for the job, and you are certain of sharp tools. It should not be necessary, but doubtless is, to say that chisel bits and plane bits should be sharpened on their bevels only—the other side should never touch the oil stone unless for cleaning off a "wire edge," and then only if the blade is laid perfectly flat on the stone.

The clever screw drivers invented and marketed within recent years which drive screws by the power of a worm, should be a part of every carpenter's kit. Yet many a bad pinch has come to those who don't reflect that if the screw driver doesn't seat well into the screw and slips out, all the power of the push is going somewhere, and that if a finger be in the way at the tool end, an injury is bound to result. See that the beads for such a tool have square ends, not rounded ones, and are not too large for the screw—push straight, keep your fingers out of the way.

If there is one single cause more than another which prevents the amateur doing good cabinet work, it is hurry, desire to see results, and failure to lay off work properly. It is much better to spend five minutes laying off a saw cut and one minute sawing it, than one minute laying it off and five minutes sawing it. No tool work ought ever to be hurried, but he who hurries laying off the work, ruins it before a tool is set to it—started wrong, nothing can save it. Have sharp scratch awls and pencils, reliable squares, rules and gages, and use them with care and in a good light.

Workshop Notes

Oiling Clocks, Etc.—When oiling clocks, typewriters, sewing machines, and all small intricate machinery where a small drop of oil is required to be deposited on a difficultly accessible part of a machine, use a piece of braided picture wire of the necessary length. Unbraid the end for an eighth of an inch and dip it in the oil. A drop may easily be carried by the wire and deposited where desired.—WILLIAM F. SHEAF.

To Restore Burnt Steel.—To restore burnt tool steel, heat the piece to a red heat, then sprinkle over it a mixture of 8 parts red chromate of potassium, 3 parts saltpeter, ¼ part aloes, ¼ part gum arabic, and ¼ part rosin. Machine tools treated in this way will stand up as well as before they were burned.—C. D. H.

Substitute for a Mandrel.—Here is a suggestion for your department: The making of a mandrel can many times be avoided by using the drill chuck and drill in the lathe as follows: After drilling the hole, slide the piece of material well up on shank of drill as near the chuck as possible; then fit pieces of soft pine or similar wood in the flutes of the drill, and drop a few drops of water on these wooden wedges, when they will swell tight enough to hold vulcanized fiber or brass and even steel for light turning.—GEORGE CROSTON.

Cold-water Annealing.—The following method of cold-water annealing has proven to be highly successful on common grades of steel: Heat the steel to a dull red, and then, holding it in a dark place until the red disappears, dip it in cold water. It can then be easily machined or filed. Another way of testing the "dipping" heat is to allow the piece to cool gradually, at the same time rubbing the steel with a piece of dry white pine. When it is nearly cool enough to dip, small particles of charred wood will rub off, stick to the steel, and glow momentarily; when this action ceases, dip the steel.—H. D. CHAPMAN.

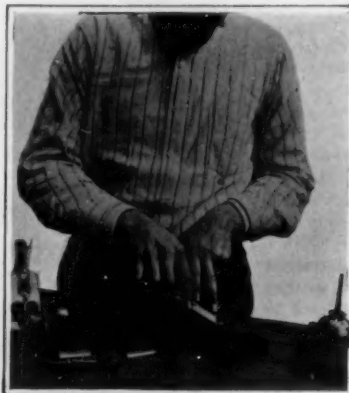
The Use and Misuse of Tools.—II

By C. H. Claudy

(Concluded from the issue of March 23rd, 1912.)

THE right way to start a brace and bit job is the wrong way to continue it—the right way to bore a hole with a brace and bit is the wrong way to start the hole!

This contradictory doctrine is fully expounded in the photographs. In that showing the beginning of a hole to be made with brace and bit, the tool is seen held at arm's length, the position best adapted to letting the workman see that his tool is perpendicular with the hole he is to bore. On the contrary, if he continue to bore in this position, the alternate pull and push of the brace handle, as the tough fibers of the wood resist the cutting action of the blade and the action of the worm pulling the bit down, will speedily throw the hole out of true. If indeed it does not result in bending the bit. On the contrary, the position shown in the second photograph is the proper one for boring, since, held in this way, the brace is steady and the pulling and pushing on the handle exerts the minimum effect on the position of the bit. Yet, to start a hole in this position is to have no certainty of its direction, and is also to waste strength, since no muscle is needed to start a brace and bit pulling, as long as the worm is sharp enough and cut deep enough to pull the bit down. When the middle of the hole's depth is reached, it not infrequently happens that the resistance of the wood to further cutting is greater than the power of the wood to hold the worm, and then some pressure is necessary to keep the bit at work—this pressure can only be applied with the weight or push of the body, and can



To sharpen a chisel or plane blade keep the bevel edge flat upon the stone.



Use pressure to start a bit after which it will feed itself.

What Inventors Are Doing

Simple Patent Law; Patent Office News; Inventions New and Interesting

Women as Inventors

By C. H. Claudy

IT has been but a short time since woman entered other fields of effort than those provided by the home. Yet she now writes books, music and plays in open and successful competition with her mate, produces works of art, sculpture and painting, competes with him on the athletic field, excels him in nursing, wins fame and fortune in such professions as are open to her, such as medicine, surgery, college and settlement work, and even occasionally writes her name large in the scientific world, as Mrs. Fleming, the famous astronomer, and Madame Curie, the discoverer of radium, have done. Perhaps it is because she hasn't yet wanted to put it there, that her name is not on the list of great inventors. She can not yet claim a telegraph, telephone, steam engine, electric light, reaper, binder, cotton gin, spinning jenny, improved loom, wireless telegraph, aeroplane, or automobile.

The reason is not far to seek. She hasn't had time. When the 1910 census came to the question of patents and it listed 944,525 patents granted to men in this country since the beginning of the patent system, but 8,596 patents were credited to women, nine-tenths of one per cent of the total issue. But the percentage of patents granted to woman increases yearly. Thus, from 1790 until 1888 there were 2,455 patents granted women, and from 1888 to 1895, 2,526, in seven years more than doubling the total that had been accruing for the previous ninety-eight years. And from 1895 until 1910 there were 3,615 patents more, bringing the total number up to 8,596, as stated.

The first patent granted to a woman in this country went to Mary Kies for a process of straw and silk weaving. The patent was issued May 5th, 1809, before the system of numbering patents went into vogue. The second patent given a woman was issued more than six years later. Miss Mary Brush had an idea for improving a corset and on July 21st, 1815, received her patent on that invention. Patent number three to a woman went to Miss Sophie Usher, four years later, and on September 11th, 1819, she became owner of a United States patent on a process for making violet water and cream of tartar into a toilet lotion.

Not until the eighth patent to a woman came to issue did madame leave such womanly subjects as weaving, kitchen utensils, clothing, and cosmetics for the sterner arts. On May 20th, 1826, one Phoebe Collier procured a patent on sawing wheel fellys, which apparently inspired another woman to leave her sphere for an excursion into man's domain, so that when Miss Elizabeth H. Buckley took her patent home with her, the ninth issued to a woman, she had sole rights to a certain way of making a sheet-iron shovel—this was February 28th, 1828.

Unfortunately, the great Patent Office fire destroyed many early documents and copies of patents, so that much information about these early issues is hard to get. It is a pity that we do not know what Miss Harriet Cook had in mind when she received the fifteenth patent granted to a woman, February 20th, 1833, for a "calash balloon for ladies." Is it an article of dress? Or an airship? One suspects a bustle, but speculation has no place about so serious a matter as a patent.

The first numbered patent to go to a woman was number 1,075 on February 2nd, 1839, to Eliza Ann B. Judkins for a method of "shedding." Whether "shedding" indicated some early depilatory process or a manner of putting up outbuildings or refers to taking the heart out of fibers of some sort, is not known.

The great civil war which flooded the Patent Office with devices of all sorts applicable to carnage and blood-shed from inspired citizens who desired thus to aid their country (at a price) while being safely taken care of back home, had little influence in stimulating women to invent. But few patents granted during those years were to women, and of those few, but a scant half dozen have any bearing on the war. Martha Willis of Rochester, N. Y., received patent No. 31,843 in 1861 for a bandage, and Clarissa Britain of St. Joseph, Mich., patent No. 39,400 for an improved ambulance in 1863. Apparently having an eye more to military beauty than the care of the injured, one Sarah Morsman of Cleveland, Ohio, paid for patent No. 39,667 in the same year on an improved military cap. But Mary C. Ross and Louisa Anderson, the first of New York, and the second of St. Louis, were more tender hearted. Miss Ross took two consecutive patents—40,642 and 40,643, on a liniment and a salve, respectively, while Miss Anderson thought of the old soldiers

and took 40,668 on a rheumatic liniment—all three of these patents being dated November 17th, 1863.

There are a few scattering patents to women to the end of the war, one for a process of building war vessels (!) but most of them confined to bandages, medicine and comfort for the sick.

A strange feature of women's inventions as shown by Patent Office records is that a child's toy was not patented by a woman until as late as 1867 when Elizabeth Hawks procured patent No. 64,102 on a plaything for babies.

The great majority of patents granted to women have to do with articles of dress and domestic or farming apparatus. Improvements in corsets and new de-

signs in these garments get more attention from the woman inventor than any other one thing. But the other articles of dress run a close second especially in more recent years when improved methods of manufacture have made possible so many variations in underwear. Improved and new designs in underwear, in children's garments, in hose supporters, in shoes, caps, hat pins, safety pins, stockings, all get a great deal of attention from women inventors, again closely pressed by her interest in kitchen and garden utensils and in farming tools. Occasionally the woman inventor takes a dive into more abstruse realms and gets a patent on a means for desulphurizing ore, or mounting fluid lenses, or an improved method of guiding traction engines, but the vast bulk of her inventions relate either to her dress or those things which more immediately surround her in her household life.

But the fair sex has not confined its inventive faculties either to strictly feminine matters, nor to science, art, manufacture or the art of war. Among the patents granted to women are many devoted to masculine comfort, among which are to be noted a Trouser Tree, a Mustache Guard, a Machine for Making Cigarettes, a Man's Necktie Clasp and Holder, a Protector for Dress Shirts, a Folding Bath Tub for Travelers, etc.

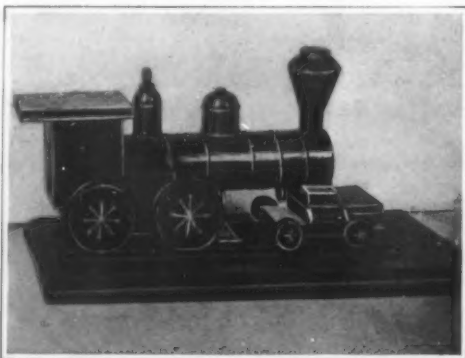
Lest some should think that because no woman has as yet made a great and epoch-making invention, therefore, she is apt to make ridiculous inventions and obtain those freak patents so beloved by the comic paragrapher, let it be said that the number of freaks patented by woman is small in proportion to the total number of patents she has obtained. Nor is this hard to understand—the faculty of invention is not as yet largely developed, therefore it does not over-grow itself or "run to seed." Freak inventions, of which men produce so many, are a result of an unbridled, untrained inventive faculty, which, properly directed or educated, might result in good. Woman seldom makes these varieties of inventions, and strange to say when she does get into the freak class, she is often disconcertingly close to the practical and though one laughs at the freak, he cannot but see that there was a real idea to the fore even if the means and result are somewhat *outré*.

There is, for instance, the patent granted to Mary Ann Woodward April 24th, 1846, for a rocking chair fan, and a picture of her dainty model is here shown. Mistress Mary's idea is certainly not bad—if one is not of a nervous disposition. You sit in the chair and rock. The fan above swings to and fro and keeps the flies off your bald head and at the same time impels a cooling breeze to keep you from getting overheated. Whether she stood ready with another invention for the sudden cure of pneumonia or kept an ambulance on hand for the carrying off of those made suddenly insane by the flick-flick of the thing across their heads, her patent does not state.

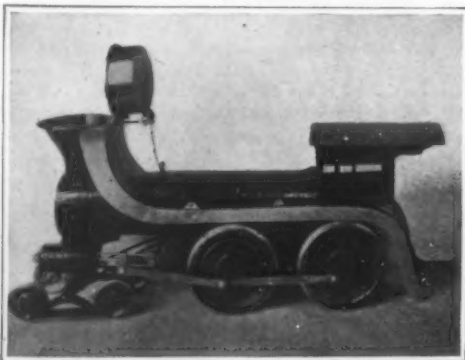
Mrs. Sarah Sewell, an Ohio woman, invented a device which cannot be called impractical even if at first blush it does not seem destined to produce an undue amount of cleanliness. Observing her small children at play on a see-saw, the while she worked hard revolving the mechanism of a washing machine, she conceived the idea of making the see-saw do the work, giving her time to enjoy life. And the United States of America set its solemn seal of approval on this idea, giving her a patent for a combined see-saw and washing machine, the illustration of which shows the beauty of possessing at once, several children and an inventive brain by which they may be made to wash their own clothes and at the same time have a good time.

A list of half freakish, half sane inventions of women would not be complete without mention of two locomotive patents granted to women, one for destroying vegetation between the tracks, thus keeping cows off and conserving their precious lives, and the other a means by which cinders and smoke may be kept on the ground and thus out of the passengers' eyes. Louisa B. Simpson, of Lawrence, Mass., took out the first mentioned patent, which produces its vegetable destroying effect by discharging waste steam via a tube straight down between the wheels. Miss Augusta M. Rodgers of Brooklyn, N. Y., patented the second railway engine idea, carrying her cinders and shot through a tube back over the engine and down to the ground. Doubtless if this device worked the way it was planned to work, and did not seriously interfere with the draught of the chimney, it would have the same effect as that of Miss Simpson's patent, and not only keep cinders on the ground but by them destroy the vegetation.

For some unknown reason, the name of Sarah P.



To kill vegetation between the tracks.



To lead cinders and smoke to the ground.



Rocking chair, fan, and fly remover.

LEGAL NOTICES

PATENTS

If you have an invention which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

All communications are strictly confidential. Our vast practice, extending over a period of more than sixty years, enables us in many cases to advise in regard to patentability without any expense to the client. Our Hand Book on Patents is sent free on request. This explains our methods, terms, etc., in regard to PATENTS, TRADE MARKS, FOREIGN PATENTS, etc.

All patents secured through us are described without cost to the patentee in the SCIENTIFIC AMERICAN.

MUNN & COMPANY

361 BROADWAY, NEW YORK
Branch Office, 625 F Street, Washington, D. C.

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

AERONAUTICS

FLYING ALL WINTER—Greatest Money Maker in the World. We make you a Pilot in 10 lessons—\$250—We stand all breakage. For further particulars address Stevens & Beatty, 232 9th Ave., N. Y.

AUTOMOBILES AND MOTORCYCLES

AUTOMOBILES, \$50.00 up; Motorcycles, \$30.00 up; guaranteed for one year, shipped freight prepaid. Largest list and lowest prices in the world. King, Automobile Broker, Dept. 3, A., 215 West 125th Street, New York City.

BUSINESS OPPORTUNITIES

SELL YOUR GOODS IN SPAIN—Correspondence invited from American manufacturers and inventors desiring representation in Spain. Willing to pay cash for any goods handled. References: Board of Stock Exchange, or any bank in Madrid, G. L. Quesada, Stock Exchange Broker, Goya St., Madrid, Spain.

Responsible party with means and energy would handle proposition of merit, which town of 5000 and well populated surroundings will support. No catch-penny proposition considered. Box 41, Cherokee, Iowa.

FREE SAMPLE goes with the first letter. Something new. Every firm wants it. Orders from \$1.00 to \$100.00. Nice pleasant business. Big demand everywhere. Write for free sample. Metalite Mfg. Co., 438 N. Clark, Chicago.

ACTIVE SALESMEN easily make \$300 monthly selling our perfect dry Chemical Fire Extinguisher; exclusive territory assigned; District Managers Wanted. United Mfg. Co., 1143 Jefferson, Toledo, O.

LOCAL REPRESENTATIVE WANTED.—Splendid income assured right man to act as our representative after learning our business thoroughly by mail. Former experience unnecessary. All we require is honesty, ability, ambition and willingness to learn a lucrative business. No soliciting or traveling. This is an exceptional opportunity for a man in your section to get into a big paying business without capital and become independent for life. Write at once for full particulars. Address E. R. Marden, Pres., The National Co-Operative Real Estate Company, 1 578 Marden Building, Washington, D. C.

PATENTS FOR SALE

U. S. PATENT FOR SALE, Switch for Incandescent Electric Lamp-Socket, Great improvement over ordinary socket, cheaply manufactured, operated without jarring globe filament. Will McDonald, Grampian, Pa.

PATENT on upright rotating album book-stand No. 1,017,460, most advantageous of albums. Will adorn any household and can be made cheaply. For full information and terms address, Giuseppe Palverino, 236 West 27th Street, New York City.

FOR SALE

FOR SALE.—Patent No. 1,016,010, for driving mechanism for moving picture machines, having broad claims. Address John J. Hesse, 134 Elliot Street, Boston, Mass.

FOR SALE OR ROYALTY.—Patent on highly endorsed hygienic article, universal usefulness in Bicycle, Typewriter, Novelty line, money-maker for competent mfrs. Address Z. H. Blouch, Lebanon, Pa.

WANTED

PATENT WANTED. Owners of processes for extraction of aluminum from kaolin; address particulars and royalty expected, W. C. Marshall, 308 Union Oil Building, Los Angeles, California.

WANTED.—A man or woman to act as our information reporter. All or spare time. No experience necessary. \$50 to \$300 per month. Nothing to sell. Send stamp for particulars. Sales Association, 633 Association Bldg., Indianapolis, Indiana.

WANTED addresses of manufacturers of good reliable kerosene carburetor or some process of converting gasoline engine into kerosene engine. Address, Phillips Gasoline Engine Co., 230 N. Jefferson St., Chicago, Ill.

MISCELLANEOUS

LEARN TO WRITE ADVERTISEMENTS.—Earn \$25 to \$100 weekly. We can positively show you by mail how to increase your salary. Prospectus free. "Pace-Davis Co., Dept. 59, Chicago, Ill.

GARMENT MEASURING DEVICE by which the shape of the human form can be ascertained by square measurement; absolutely superior; so perfect and simple it must remain superior. C. Ryan, 261 State Street, Ottawa, Can.

BECOME A DETECTIVE.—Earn \$150 to \$300 per month traveling over the world. Send stamp for particulars. Write, Frederick Wagner, 1243 Lexington Avenue, New York.

VACUUM CLEANER AGENTS WANTED, to sell celebrated Thurman Vacuum Cleaners, standard of the world. Made by originator vacuum cleaner. Write today for free Booklet "I can make yours a dustless home." Thurman Vacuum Cleaner Company, Syndicate Trust Building, St. Louis, Mo.

Mather has often been published as the author of a freak invention. In 1845 Miss Mather obtained patent number 3,995 for a submarine telescope and lamp. Probably it is because the subject is an unusual one for a woman that paragraphers have heaped gentle ridicule upon the device. As a matter of fact the idea is entirely practical, and to prove it, Miss Mather left with the Patent Office a full sized working model which the writer has seen and handled and which shows no trace of either the freak or the impractical.

No story of woman's inventions would be complete which failed to mention the "feminine" patent taken out by Minnie Agnes Phelps of Chicago, Illinois. This is a recent patent, which still has eleven years to run, having been granted December 11th, 1906. It is remarkable as being the invention of a woman, the application for which was prosecuted by a woman attorney, Miss Florence King, and the witnesses to which were both women, Jennie L. Fiske and Cora A. Schriver. It is an "all woman" patent, and to complete the sentiment, its subject is one particularly of woman's domain. The patent is for "certain new and useful improvements in a combined toaster and warming oven."

There are about 60,000 applications for patents filed every year in the patent office. Of these, two thirds, or about 40,000 go to issue. Of these forty thousand, each year sees an increasing number issued to woman. A feature which is generally remarked by all who handle patents is that comparatively few inventions claimed by women and filed for patent are rejected—when she has an idea for an invention, she is usually sure of its use, practicability and novelty.

Of the rewards earned by women in invention it is hard to get data. A car-coupler brought one woman a large royalty, a printing press improvement netted another a neat sum. A young woman now living in New York draws a royalty of several hundred dollars a month from an invention regarding the making of button holes on strips of cloth, sold in all shops to women who buy them to sew into shirt waists, etc. Many inventions relating to dress and household utensils have brought handsome rewards to the brains which conceived them, and many design patents by woman designers are applied to articles of every day use everywhere.

As stated before, while no woman has as yet written her name beside that of Morse, Edison, Howe, Whitney, Goodyear, or McCormick, there is no reason why she may not do so. Women so far have taken out less than one per cent of the total patents issued. But a very, very, small fraction of one per cent of the total patents issued can be minutely resubdivided and still be a number too large to apply to the real epoch making inventions, so that there is plenty of time for Mlady to make her great invention and still be well within the operation of the law of averages.

Rehearing of the "Rotary Mimeograph" Case

ARTHUR VON BRIESEN, counsel for Sidney Henry et al. v. A. B. Dick Company, has filed a petition for a rehearing in the now famous "rotary mimeograph" case. The rehearing was asked for solely on constitutional grounds, the appellee pointing out that the practice has been established of determining constitutional questions by a full court in order that the judgment may represent the view of the whole court. The original decision, it may be remembered, was not handed down by full court. Moreover, four judges united in the prevailing and three in a minority in dissenting opinion. The rule of hearing constitutional questions by a full court was laid down by Chief Justice Marshall in *Brice v. Commonwealth Bank*, 8 Peters, 118, and *City of New York v. Miln*, 8 Peters, 120, 122.

The petition also recites that on the question involved the courts in the several circuits have held divided and opposing opinions, there being four circuits on one side of the question and two on the other side,

The Story of Swift's Premium Oleomargarine



Swift's Premium Oleomargarine is a sweet, pure, clean, food product made from rich cream and edible fats. It contains every element of nutrition found in the best creamery butter.

The process of manufacture is primitive in its simplicity, but modern in its cleanliness and purity.

The butter fat in Swift's Premium Oleomargarine is microscopically and chemically the same as in the best butter; the only difference is in the way it is secured from the cow.

Butter fat in butter is all obtained by churning. In Swift's Premium Oleomargarine from $\frac{3}{4}$ to $\frac{1}{2}$ is obtained in that way, the remainder is pressed from the choicest fat of Government inspected animals. This pressed fat is called "Oleo" hence the name "Oleomargarine."

Rich cream, fancy creamery butter, 'oleo' 'neutral' vegetable oil and dairy salt are the only ingredients of Premium Oleomargarine. 'Neutral' is an odorless and tasteless oil pressed from leaf fat.

There is no coloring matter added to Premium Oleomargarine, yet it is a tempting rich cream color.

Swift's Premium Oleomargarine Factories are open to visitors during all working hours.

Each week day during the year 1911 there has been an average of more than 400 visitors through our Chicago Oleomargarine Factory.

In addition to this daily inspection by the visiting public our factories are in complete charge of Government Inspectors.

These men test the quality and character of materials, they see that the contents of every tierce of 'oleo' and 'neutral' received from the Refinery is from animals that have passed the rigid Government inspection. They see that everything about the factories is kept absolutely clean and sanitary.

Noted chemists have declared oleomargarine to be a wholesale food product.

The U. S. Government's approval stamp on an oleomargarine carton is positive assurance that the materials used are pure, clean and suitable for human food.

The name "Swift's Premium" is the purchaser's guarantee of highest quality, for the brand "Swift's Premium" will be found only on ultra quality products.

Order a carton of Swift's Premium Oleomargarine today to try it. You will find that it is a delicious, wholesome food product that you can use in your home and effect a great saving, still maintaining your standard of good living.

We particularly invite you to visit our factories and see for yourself the cleanliness surrounding this interesting industry. If this is not convenient, and you have a desire to learn more regarding this product, we will be glad to send you a book on the subject.

Swift & Company, Chicago, Ill.

Three Important Facts Concerning the much-talked-of United States Tires

The first fact

United States Tires are made as no other tires in the world are made. The co-operative method employed in their manufacture is unique in automobile tire manufacture.

Here is the method:

In four of the largest and best-equipped tire factories in the world there are at work today four corps of tire specialists, each of which formerly made a brand of tires which ranked among the world's best tires. Continental, G & J, Hartford and Morgan & Wright.

Each body of men formerly put into the tire of its particular manufacture enough of quality, enough of strength, enough of actual wear to cause the tire to become a *road* tire—a tire that easily competed with all other single-factory tires.

Now—

In the same factories today these same tire specialists are at work building tires not only as good as the know how, but—and mark this as good as their knowledge, plus the knowledge of three additional corps of tire experts, can make them.

Or, to put it another way

It is precisely as if the motorist, desiring an ideal tire, should contract with four leading tire manufacturers to build a tire that would actually combine every element of strength and every secret of manufacture known to the four companies.

It is inconceivable that such a method of tire manufacturing should not produce a grade of tires that is *distinctly* better than could possibly have been produced by any one of the factories working single-handed.

The second fact

You can buy United States Tires in any *style* you prefer.

Three styles of fastening—Dunlop (straight side), Quick Detachable and Clincher, and different treads—Plain, Bailey, Nobby, Chain.

If you are convinced that a certain style of fastening or tread can best serve your purpose, you can not only get it in a United States Tire, but—what is even more important—you can get it in a tire made as *only* United States Tires are made.

Thus the motorist who clearly recognizes our claim to his patronage on the basis of manufacturing methods is enabled to take advantage of our tires regardless of *personal* choice in the matter of fastening or tread.

The third fact

United States Tires cost no more than you are asked to pay for other kinds.

This opportunity to secure extra value with out extra cost has naturally appealed to motorists who are wedded to no tire but the most economical tire it is possible to buy.

There is every indication that the spring season will witness thousands of motorists putting on one, two or more United States Tires for the first time—motorists who are convinced that, at the same price, tires made by our co-operative method most certainly should give exceptionally large mileage returns for their investment.

Knowing as thoroughly as we do what our four-factory method of manufacture means in the production of superior grade tires, we frankly invite every motorist who, without prejudice, is looking for a full return on his tire expenditure, to use United States Tires as either partial or exclusive equipment during 1912.



Tire-by-Tire
Satisfied
thank you

America's Predominant Tires

At no greater cost than other kinds

SOLD EVERYWHERE

United States Tire Company, New York

THE EDISON CONCRETE HOUSE

These and other important questions relating to the structure are discussed in a good, thorough, illustrated article published in *Scientific American Supplement* 1685. Price 10 cents by mail. Order from your newsdealer or from

MUNN & COMPANY, Inc. Publishers
361 Broadway, New York



Keep It Handy

You will find uses for it every day in the week. Has no equal in cleaning the hands of dirt and grime. Cuts grease from floors quickly and easily. Absolutely harmless to the skin or articles cleaned.

Many Uses on
Large Shifter-Can 10c

Old Dutch Cleanser

two not committed to either side, and the last circuit propounding the question which was finally decided by the Supreme Court. That question is the right of every individual to have unrestricted use of articles unprotected by letters patent.

The Attorney-General has filed application for permission to intervene in the case on the ground that the government is concerned in a number of cases, civil and criminal, now pending for the enforcement of the anti-trust laws, and that the case is not limited in its significance to the litigants, but is of the gravest importance to the people of the United States. The Attorney-General cites that article of the Constitution of the United States which provides that Congress shall have power to promote progress of science and useful arts by securing for limited times to authors and inventors, the right to their respective writings and discoveries, and asks for a determination of the nature and extent of the exclusive right thus constitutionally secured.

Furthermore, there is involved the construction of the Sherman Act in so far as the question is to be determined whether things done in violation of that act are legal if they are the result of exercising the exclusive right of authors and inventors to their respective writings and discoveries.

Notes for Inventors

Uses File as a Drill Bit.—A friend of ours has a fine bathroom in his new house. He wanted some small fixtures applied to the tiled wall. He was interested when the workman came to put them up by the facility with which he drilled the holes in the hard tiles. The workman used an ordinary hand brace. At intervals, he pinched off a small portion at the end of the bit. When asked about this he said it was a secret of his and explained that the bit was just an ordinary small size, three-cornered file and the pinching off of the end operated to re-sharpen or bring fresh cutting surfaces to place. He would first start the hole with a hammer stroke on a punch after which he would drill the holes, the time for drilling eight holes, inserting wooden plugs and applying three fixtures being only about half an hour, the drill cutting almost like an auger in soft wood.

Should an Invention Be Kept Absolutely Secret Until Patented?—When the inexperienced inventor conceives an invention which he thinks is important and valuable, his first impulse is to keep it a secret and to explain it to no one for fear his invention will be stolen. Here he frequently makes a serious and sometimes a fatal mistake, for a patent as between two or more contestants is awarded to the one who conceived the invention first, provided he proceeded diligently to complete the invention. Now if he keeps the invention a secret until he completes it he is not able to take advantage of his earlier conception. Therefore his wise course is to explain the invention which he has conceived to one or more persons in whose integrity and ability he has confidence, and these persons should be made so familiar with the invention by descriptions and sketches which they may sign and date, as to be able to explain the construction and operation of the invention at a later day if it should become necessary for them to give testimony for the inventor. Following the conception of the invention, the inventor should lose no time in completing the invention, putting it into practical successful use and filing his application for patent, but these are other stories and will be referred to in a subsequent issue.

An Electrolytic Razor Sharpener.—Charles Francis Jenkins, the well-known Washington inventor, has recently patented an invention utilizing electrolytic action for sharpening implements. The invention is based upon his discovery that to secure rapid electrolytic action it is not necessary to immerse the metal in a liquid bath. In one embodiment a razor is stropped in the usual way upon a strop which is saturated with a suitable electrolyte. Conducting wires in the strop are connected with a source of current, the razor being also electrically connected to the same source, and the razor is rapidly brought to the desired condition for cutting.



When price tempts you to buy cheap tools—don't do it. The good carpenter doesn't buy a cheap saw, and no one else should.

If you are a house owner, you'll find your household will be neater and better "kept up," if you own a few tools, especially a good saw.

Don't buy a cheap one. In a

SIMONDS SAW

(Pronounced Si-monds)

you get teeth which hold their edge and set against long, hard use. They cut true and fast, long after the cheap saw has lost what little edge it had.

It's the Simonds Special Crucible Steel which makes Simonds Saw teeth stand the wear. Our special process gives a uniform temper and a toughness you don't find in other saws.

Simonds Saw handles are shaped right and properly set on the blade and the saw has an easy, comfortable "hang" that even the amateur recognizes.

Ask Your Hardware Dealer

Remember Simonds Hack Saw Blades and Files are most efficient. Simonds Circular, Band and Cross-cut Saws are the American and Canadian lumbermen's accepted standard.

Send for "A Carpenter's Guide Book"—Free—and read about filing hand saws.

SIMONDS MFG. CO. (Founded 1832) Fitchburg, Mass.
Chicago New Orleans Portland New York
San Francisco Seattle Montreal Lockport, N. Y.

PALMER MOTORS AND LAUNCHES
Catalogue M Free of Motors.
Catalogue B Free of Boats.
ENGINES FROM 2 TO 40 H.P. PALMER BROS.
IN STOCK COS COR. CONN.

365 Days Trial
Our monthly payment plan makes it easy for anyone to have the best heating system made.
JAHANT DOWN-DRAFT FURNACE
Draft
Saves one-half on your fuel bills; gives plenty of heat and thorough satisfaction. Every Jahant Furnace is sold with a strong "Guaranty Bond" that allows 365 Days Trial. You can install the Jahant Down-Draft Furnace yourself. We send complete outfit—furnace pipes, registers, etc.—with special plans, full directions and necessary tools for installing.
We pay freight. Send for Free Book.
The Jahant Heating Co.,
75 MIN ST., Akron, O.

Two Cents a Week Pays Wash Bill!

This Washer eliminates labor and practically saves all cost. Does a big family washing for 2 cents a week—yes, and the wringing, too. It's one of the greatest marvels the world has ever known. Runs by electricity or water power. Washes a tubful spotlessly clean in two to six minutes! Wrings out the clothes to perfection as fast as you feed them—prove it at our expense.

Any Woman Can Have a
1900 Motor Washer
On 30 Days' Free Trial

Don't send money. If you are responsible, you can try it first. Let us pay the freight. See the wonders it performs. Thousands being used. Every user is delighted. They write us bushels of letters telling how it saves work and worry. Sold on little payments. Write for fascinating Free Book today. All correspondence should be addressed to **1900 Washer Co., 5072 Court St., Binghamton, N. Y.** If you live in Canada, address Canadian 1900 Washer Co., 335 Yonge St., Toronto, Canada.





Buy Paint that is Scientifically Prepared

There's something of Chemistry and of Physics in the making of good paint. It requires scientific knowledge to obtain a product so combined as to make a paint of greatest adhesive and cohesive properties that will resist the destructive, weather elements. In making

Lowe Brothers High Standard Liquid Paint

"the Paint of Performance"

all materials are subject to chemical analysis, and in addition the paints are submitted to practical weather tests. That's why each "High Standard" color is always the same—why the consistency is so uniform—why the paint when applied sets in a tough, weather-resisting skin and adheres tightly—proof against the sun's rays and the extremes of temperature.

Mellotone Mill White

Lowe Brothers Mill White saves light bills and repair cost. Use it for interiors of factories and other buildings where a durable, light-reflecting covering must be economically secured. Its remarkable hiding power and easy washing qualities make it popular. Practical in every factory. Gloss or flat finish.

Lowe Brothers Concrete and Cement Coating

is the finish that renders all concrete work impervious to moisture, prevents alkali action and discoloration, and gives a smooth and pleasing surface. It comes in a variety of colors, ready to use. No cement work is complete without this finish. **Lowe Brothers Elastic Cement Floor Finish** may be used with it for floors.

Write for Booklets

of full particulars on these and other High Standard products. In the Lowe Brothers' line there's a paint, varnish, enamel or stain for every purpose.

Buy from your local "High Standard" dealer. If you don't know him we will introduce you. Or write us direct regarding your wants and let us make practical suggestions.

THE Lowe Brothers Company

474 E. Third St., Dayton, O.
Boston - New York - Chicago - Kansas City

LOWE BROTHERS, Ltd.
Toronto, Canada



Uses Living Trees in Railroad.—Jerome Orlay of Temsche, Belgium, in a patent, No. 1,020,570, provides an elevated railroad. The claim of the patent includes "inclined live trees." These are interposed between the inclined poles of two rows, the poles being connected to the live trees and an elevated track being carried by the poles. The tree tops with foliage cross above the elevated track.

New Rubber Substitutes.—In two patents, Nos. 1,020,497 and 1,020,498, Albert H. Henderson of Baltimore, Md., presents improvements in the rubber substitute art. The first patent covers rawhide expanded to the form of a permanently spongy substance with rubber in the pores or interstices, while Patent No. 1,020,498 is for the method resulting in the composition of the first patent.

A New Mail Bag Exchange System.—Albert Hupp of Kansas City, Mo., has patented No. 1,020,609, a mail bag handling system in which the door of the car is opened by means actuated by the revolution of the axis of the car, a stop normally holding such means from operation and a trip on the roadbed operating to withdraw the stop so the door-opening means can operate at the proper point.

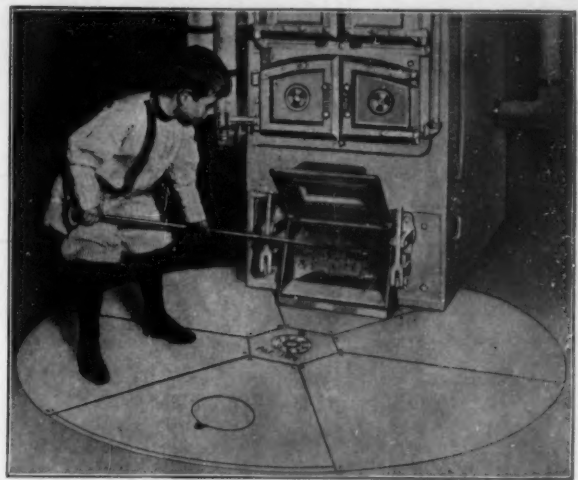
Hot Water to Repel Boarders.—It is told of the late Admiral Evans, often referred to as "Fighting Bob" Evans, that on one occasion in a South American port some local officers boarded his ship and demanded a political refugee he was harboring. The Admiral refused their demand and ordered them off ship. Upon their refusal to go he ordered hose coupled up with the boilers and gave them the alternative of going in five minutes or taking a hot bath. They went "dry." The Admiral may not have known that in 1867 a Cleveland, Ohio, man of the name of Ross, patented a device for ejecting hot water on war vessels for repelling boarders. He operated his nozzle from within a revolving shot-proof turret which could be turned to point the nozzle in any direction. He also elaborated the apparatus in other respects.

Another Edison Phonograph Patent.—Thomas A. Edison has patented No. 1,020,485, a phonograph reproducer in which a diaphragm is mounted in a sound box and a member is mounted to turn on a floating weight, the stylus lever being pivoted to the member and connected to the diaphragm.

Re-tails the Animal.—A novel device is presented in a mechanical picture patented, No. 1,012,747, to Paul H. Suhling of Chicago. It is a card which bears the pictorial representation of an animal devoid of its tail, and an elastic spring is secured at one end of said card at the point of attachment of the tail of the animal pictured thereon and the spring which forms a mechanical tail projects from the pictorial face of the card.

Legal Notes

Price Restrictions and Patent Licenses.—In *Indiana Manufacturing Company v. Nichols & Shepard Company*, in the Circuit Court E. D., Michigan S. D., the Court, speaking by District Judge Denison, held that where a licensee under a patent entitling him to use a patented machine under certain conditions only, undertakes to use the machine otherwise than in conformity with such conditions, he loses the protection of his license and is liable as an infringer; also that where a license authorizing defendant to use certain patents provided that he should maintain specified prices and should place certain trade-mark plates on each machine and that it should make reports of sales and pay royalties, such provisions as to maintenance of price and application of trade-mark operated as conditions of defendant's right to use the patent, though not so as to reports of sales and for payment of royalties; also that a price restriction in a patent license is a valid condition; also that where a patent licensor conceives that the licensee is operating outside of the agreed field, the licensor may elect to disregard the license and sue for infringement or, if he can show he has no sufficient legal remedy, he may sue in equity for specific performance.



THE Sharp Rotary Ash Receiving System

Marks another progressive step in home improvement.

Because

FIRST:—It has its application in an important but heretofore neglected field—the domestic heating plant.
SECOND:—Its operation consists in robbing the ashes problem of its terrors.

How?

By positively eliminating all dust in connection with the removal of ashes, thereby promoting sanitary conditions.
By eliminating 95 per cent of the labor of ash removal, thereby saving valuable time.
By providing a fireproof vault for the hot ashes, thereby decreasing fire risk and saving insurance.
By increasing the efficiency of your basement, because every visible indication of the presence of ashes is absent, and the space can be better utilized.
If these facts appeal to you write for the catalog and see how we accomplish these results.

W. M. SHARP CO., 160 Park Ave., Binghamton, N. Y.

Special New Proposition on the New Thin Paper Edition

NEW INTERNATIONAL ENCYCLOPAEDIA

22 Volumes 70,000 Articles 20,000 Illustrations

THE offer of a special Pre-publication price on the new thin paper edition in beautiful, strong cloth binding is one which will be open to Scientific American readers for a short time only. We have made it partly to gain quick introduction of these fine cloth-bound sets among representative people, and partly to offset the inconvenience of the present slight delay in deliveries caused by a tremendous sale and great pressure on our binderies.

The pressure on the binderies will, however, soon be relieved by additional arrangements, and the full quota of sets delivered, after which the price will be advanced to the regular price. Until then, the special price on the thin paper Cloth sets puts the work within reach of all; and there is also a special offer on the beautiful Half Russia and Full Russia thin paper sets which will attract many.

Read What Is Said About The New International

Speaking of the completeness and accuracy of The New International Encyclopaedia some time ago, *The Scientific American* said editorially: "Many subjects are treated for which we have looked in vain in other works of similar nature. There are over 20,000 illustrations (which indicates the wealth of matter on technical subjects) and 70,000 separate articles covering all subjects. The 22 Thin Paper volumes are the latest edition—have the same size pages and same number of pages as regular volumes but are only one inch thick and one-third weight of regular volume."

The New York Sun has called the New International "the most helpful encyclopaedia in English"; the *American Library Association* "the best encyclopaedia for ready reference"; and the *New York Board of Education* has said it is "at present considered the best." It is admitted by Librarians to be the most referred to encyclopaedia in the public libraries. Its excellence makes the new thin-paper edition so desirable.

The Coupon Will Bring Particulars

Remember—the present low price on the new binding is but for a short time. If you are interested, send the coupon (or a letter) at once and get full particulars regarding the new thin-paper edition and this new binding, and also regarding the scope and contents of the great work.

We Guarantee Satisfaction to Every Purchaser—otherwise sets may be returned

DODD, MEAD & COMPANY
449 Fourth Ave., New York City

Send me sample pages showing paper, printing, maps, illustrations, etc., of your New Thin Paper Edition of the New International Encyclopaedia, with detailed information regarding introductory price, etc.

Fill out and mail this coupon

Name
Occupation
Bus. Address
Residence
Town State



Model 27—Five-Passenger Light Torpedo, \$1,250.
With Top and Windshield, \$1,350.

The Elmore Valveless Motor Gives You More Continuous Power Than Other Engines

YOU'VE read a good deal about continuous power impulses in an automobile engine—what is known technically as continuous torque.

Of course it's easy to understand that the more the power impulses of the engine overlap, the smoother and more economically the car will run. And the less the power impulses overlap, the more jerky the car-movement will be, and the more fuel it will use.

Now, in the ordinary 4-cylinder engine, only every fourth stroke of the piston has power behind it. Out of sixteen piston-strokes making up one complete operation of the four cylinders, there are four power-strokes. That is far from continuous power-impulse and far from smooth running.

Makers of six-cylinder cars have dwelt strongly on this fact, showing the greater overlap of power in a six-cylinder engine and the consequent greater smoothness of operation. And their argument is sound.

But in the six-cylinder engine it is still true that only every fourth impulse is a power-impulse—six in all to each complete operation of the engine.

In the Elmore valveless motor, every other impulse is a power-impulse—eight power-impulses out of every complete operation of the engine.

In other words, a four-cylinder Elmore Valveless Motor will develop more continuous power than any six-cylinder poppet-valve engine, with consequent greater ease and efficiency.

What Valveless Construction Means To You

Valve troubles cause ninety per cent of motor-car inefficiency. There are from 20 to 40 small parts on each valve of the ordinary engine—or from 80 to 160 parts on four cylinders. Unless all these parts work in almost perfect co-ordination—within a small fraction of a second—the cylinder begins to miss fire and ultimately stops altogether. Valve adjustments and repairs make up a large portion of up-keep expense—every motorist knows it. But the Elmore owner never has such items to pay, nor such annoyances to meet.

The One Proven Successful Valveless Motor

The Elmore motor has been in successful operation over American roads for over a dozen years. There are

thousands of Elmore owners, everywhere. And any one of them will tell you that for economy, efficiency and ease of operation the Elmore is in a class of its own. But it is well to remember that the Elmore alone can show such a long record and service; and the features which make the Elmore valveless construction valuable are patented and exclusive.

A Model for Every Motorist's Need

Whatever you desire in the way of a car, there is an Elmore which will meet your utmost requirements. We use the best materials, the highest grade of workmanship obtainable. In fact, Elmore construction is a synonym for quality in the industry. And the price range—\$1050 to \$1650—is most conservative.

Write for interesting free booklet and we'll tell you where to see the car.

The Elmore Manufacturing Co.

FACTORY: CLYDE, OHIO

Address all communications to

GENERAL SALES OFFICE 82 Congress Street, East
DETROIT, MICHIGAN

Motion Study in the Household

(Concluded from page 338.)

for washing windows, the tools that are used with such success by the trained window washers of large office buildings, and how seldom are the brooms similar to those used by sweepers in large, well kept, industrial establishments used on the floors of the residence, or are the labor-saving devices of the kitchen of the modern hotel or club used in the kitchen of the home.

With the use of what is already at hand, will come a realization of exactly what is needed best to meet the demands of the home—demands that inventors and manufacturers will be only too glad to meet. Most important of all, the interest of the housewife will be broadened, and the spirit of co-operation between the housewife and helper of the individual household and the housewives and helpers of all households will be strengthened.

Motion study is but a small part of scientific management. Through her interest in motion study the housewife will inevitably become interested in scientific management, and will carry all its methods of increasing efficiency into her chosen work. Through the spirit of co-operation must result ultimately a national and an international bureau, where the data of household management can be collected, conserved, arranged and distributed. Our work of installing improved methods and motion study in the industries shows us that the complete solution of the problem in the household is too great for any one household, or any one community. It is a question that should be undertaken and solved by the effort of all those interested working in co-operation with the schools and colleges teaching household economics, who in turn should co-operate with a national bureau for the study of this important problem. A scientific study of motion economy in the household by such a national bureau would not be all pioneer work, for such bureaus would be able to use records and parts of records that had been obtained in similar work in the industries. The scientific study of unit times of elements of processes in, say, the laundries of the hospitals, would give much data that could be used in its final form without change in the household. Our work of installing scientific management in surgery, and in the hospitals, as well as in many lines of work in the industries, shows us that not only do the same laws of efficiency govern in the hospital as in the industrial trades, but also in the households.

The results to future home makers through this co-operation and standardization can as yet scarcely be estimated. As a final outcome, all problems of household management will be automatically solved, and housework will become the skilled work that it deserves to be—a science and an art.

Thus far, not taking into account the most important result of all—the influence on future generations of spending their formative years in an atmosphere of waste elimination. Accustomed to right habits of thought and action from their earliest days, the world's workers of the future will learn the much desired "method of attack" at their mothers' knees, and the spread of efficiency through all lines of activity will receive its greatest impetus where it should receive it—from the home.

It is for the home maker of the present to hasten that glad day!

The Private Sewage Disposal Plant

(Concluded from page 338.)

closet should still be returned to the flower and kitchen garden. How successfully this may be accomplished is clearly told in Dr. Harvey B. Bashore's valuable monograph, "The Sanitation of a Country House."

The distribution of the liquid sewage may be effected similarly to the handling of tankage from barn and cow-stable, by sprinkling-cart for surface irrigation. It may be distributed by surface gutters, to the orchard, the vineyard, or the cornfield. The ordinary and convenient method is to pipe the effluent away by gravity through vitrified tiling, to some remote and limited area, and distribute through this area by numerous rows of sub-surface tiling; unless the land invaded presents a sandy and well-drained loam, a possibility of making the area sewage sick is prevented by a further system of under-drains. It is evident that this method is expensive and wasteful. Perhaps some method of distribution embracing all arable land,



A Stewart Speedometer

adds immensely to the pleasure and safety of auto-mobiling

The Stewart is the most efficient speed indicator manufactured. It never makes a mistake, never misses a second to the hour or an inch to the mile; others may cost more but they cannot do more.

Four out of every five speedometers in use are Stewarts.

The plants that make the other 20 per cent haven't the same facilities; haven't the same production; so they can't manufacture as well or as cheaply. Stewart Speedometers are built the strongest and last the longest.

Magnetic principle, employed in 85 per cent of all speedometers, making possible the use of slow moving parts; no wear; ball and jewel bearings; beautiful workmanship; remarkably accurate; 100,000-mile season odometer; 100-mile trip register, can be set back to any tenth of a mile; positive drive; no springs; unbreakable flexible shaft; drop forged swivel joint that will outwear car; noiseless road wheel gears.

Speedometer Guaranteed for Five Years

Write for hand-some 1912 catalog telling you why in our big factory we can make the best speedometer at the lowest price.

WRITE TODAY

Speedometers, \$15 to \$30
Rim Wind Clock Combinations,
\$45 to \$70



Stewart & Clark Mfg. Co.
1911 Diversey Boulevard, Chicago

Detroit Chicago San Francisco New York Boston
Cleveland Philadelphia Kansas City Los Angeles
Minneapolis Indianapolis London Paris

"SWAN SAFETY" FOUNTAINS FOR THOSE WHO TRAVEL BY LAND — BY SEA

ON TRAINS — In the parlor car how many times have you waited your turn to write a note of importance? There is only one pen for general use and someone is invariably using it. Get a "SWAN SAFETY" and you can write at any moment.

ON OCEAN LINERS — In the drawing room or library there are at the most only about six pens available. When you wish to write a last farewell to your friends, and you must have your letter written before the pilot leaves the ship, then is the time when the "SWAN SAFETY" is worth its weight in gold, as you can write at any time you wish and anywhere you wish.

For sale by all Stationers and Jewelers.
Price \$2.50 and up.
MABIE, TODD & CO.
17 Maiden Lane New York
209 South State St. Chicago
London — Paris — Brussels — Sydney

TABLOID FIRST-AID

Ready-for-Accidents outfits for motorists, aviators, travellers, home, farm, workshop, camp, etc.
Complete, reliable and portable.
Of all Druggists, or write:
BURROUGHS WELLCOME & Co., 35, West 33rd St., N.Y.

ELECTRIC LIGHTING FOR AMATEURS
How a small and simple experimental installation can be set up at home. Scientific American Supplement 1551. Price 10 cents. For sale by Munn & Co., Inc., and all newsdealers.

No Deposit — No Obligations

30 Days Free Trial

GUARANTEED TO WORK A LIFETIME
THIS TYPE OF INK-WELL HAS BEEN "CALLED FOR TIMES WITHOUT NUMBER" BUT HAS NEVER BEFORE BEEN PRODUCED AT ANY TIME OR ANY PLACE.



No. 1-B-1-2 Natural Size, Pat. Jan. 6, 1904.

THE REYNOLDS IMPROVED INK-WELL

Is constructed of two parts, reservoir and base, both glass, nothing to corrode or get out of order. There are two small wells on opposite sides of the base, one being of the right depth for a stub pen and the other of the right depth for the ordinary long pen.

These wells are both constantly supplied with fresh ink from the air-tight reservoir above. As the ink is used it is fed down from the reservoir in such quantities as to keep the ink in each well at its normal depth at all times. Therefore FRESH INK is provided without waste and without liability of OVER-LOADING the pen, the result is clean paper, clean penholder, clean hands, with no waste of ink from any source.

EASY TO CLEAN EASY TO FILL

MAKES WRITING A PLEASURE and saves one-half the yearly ink bill.

MADE IN THREE SIZES, AND TWO STYLES. Each Ink-well is provided with two nickel-plated adjustable pen racks.

SIZES AND CAPACITY. No. 0-B, holds 2 ounces of ink. No. 1-B, and 1-C, 3 ounces and No. 2-B, and 2-C, 4 ounces.

STYLES. Style B, has one opening in the Reservoir, for single desk use; Style C, has two openings in the Reservoir to adapt it for double desks.

PRICES. No. 0-B, \$2.75 each; No. 1-B, and 1-C, \$3.00 each; No. 2-B, and 2-C, \$3.25 each. 50 cts. extra in Foreign Countries.

You must SEE and TEST this Ink-well for yourself in order to realize WHY it is the one "CALLED FOR TIMES WITHOUT NUMBER." Fill in the blank order below and mail it NOW.

Liberal Discount to the Trade

THE O. K. MFG. CO., SYRACUSE, N. Y., U. S. A.
MAKERS OF STATIONERY SPECIALTIES

THE O. K. MANUFACTURING CO.
SYRACUSE, N. Y.

Please send on 30 days free trial one No. . . . Reynolds' Improved Pat. Ink-well, Price \$. . . mail or express prepaid. At the end of that time I promise to remit the price as per Number and Style ordered, or return the Ink-well, at your expense.

Name _____
Occupation or Profession _____
Street and Number _____
City _____ State _____

and which would have an increased value during the drouth of summer, may be evolved (for instance, jointed, movable, surface irrigation gutters). According to H. N. Ogden in his book on "Rural Hygiene" under-drains are needed only when the ground water level is within three feet of the surface; they are needed to take care of the soil water, and not to drain off the sewage, and in a number of cases have been laid under a sewage filter at considerable expense, only to find that when the filter was in operation they were never in use.

It has been found desirable to apply the liquid sewage intermittently, or alternately to two separate areas. Alternation is practised in England. The grass cut from such areas every second week through the summer is packed in silos for winter feeding. If the fields are used for grazing, the cattle are alternated with the sewage from one field to the other, and the number of head thus fed is astonishing.

The intermittent discharge of sewage from the plant is accomplished by automatic syphon placed in the accessory adjacent flush tank, or by a hand valve placed at the outlet to this chamber. In either case an overflow pipe should be provided.

The complete plant then will consist of a two-chambered tank constructed of masonry or concrete, which receives the raw sewage, and an automatic syphon or hand valve which permits the intermittent discharge of the effluent through tilting to a natural or artificial filtration bed. The tank should have a capacity of one full day's flowage; ten persons, using 25 gallons of water each per day, would give a total amount of 250 gallons, which would require 33 cubic feet; or dimensions of 3 x 3 x 4 feet.

The construction of a sewage disposal plant for the home should be reduced to the simplest container and mechanism compatible with efficiency. With this end in view the Engineering Experiment Station of the Iowa State College, following many inquiries for suitable sewage disposal plants, inaugurated investigation for their design, construction and operation. They advocate an equipment, fully detailed with cost of construction in their Bulletin No. 6, vol. IV. This plant may be installed for \$100, something less than the cost of a good silo. The bulletin also includes drawings of a plant built in 1905 for the college custodian and in use since that date, with only one clean-out, which was done one year from the time of the construction.

A three-chambered subsurface disposal system, designed by Mr. W. C. Tucker, sanitary engineer, for a house with three bath rooms of about twenty fixtures was installed in a country home near New York city for the total sum of \$230, including tanks and field work. The maintenance of these systems requires intelligent supervision. Several construction firms claim to have patented automatic appliances which render sewage purification plants independent of manual attention. Gerhard gives the opinion that hand operation of valves, etc., is preferable, as it keeps the system under observation.

Requirements of sewage disposal plants are: (1) Preliminary treatment of sewage to liquify solids and suspended impurities, and hold back grease, scum and sludge; (2) purification of effluent by natural or artificial filtration; (3) an acre or more of land; and (4) slope sufficient for sewage to flow by gravity.

Life Without Bacteria

(Concluded from page 583.)

sterilized air, sterilized water and food, and the temperature is maintained at a suitable level. Here the chicks "live in clover" until the fourteenth day.

The incubator is connected with the runway by a large opening which is hidden by a split curtain that has a mica window in the upper part. The incubator is lined two-thirds of its height with a thick layer of asbestos. As seen from the figure, the ends of the glass cylinder are supported by two bronze disks which fit the ground edges tightly, and are held together by four long bolts. One of the disks carries a connection for the introduction of air under control; the other has two openings large enough to admit the hand of the operator and various tubes, etc. These larger openings are covered with copper caps, and all joints are arranged to be absolutely air and dust proof.

Water is carried through a horizontal

In the POSTAL LIFE you insure direct and receive the agent's commissions

"Direct": that is the word that exactly describes the way in which you do business with the Postal Life Insurance Company.

Because you do business in that way you save and receive what other companies pay to agents.

It is the only American company that dispenses with agents, general agents, collectors and branch offices; policyholders get the benefit.

45% Of the premium is the average Commission-dividend on a whole life policy **guaranteed** to Postal policyholders the **first** year.

In subsequent years, Renewal commission-dividends and office-expense savings, make up the annual **guaranteed** dividend of **9 1/2%**

In addition to these guaranteed dividends, the Company apportions and pays annually the usual policy-dividends ranging this year up to twenty per cent. of the premium.

The Company receives applications from all the States; its policy contracts are valid and binding wherever the policyholder resides, and it maintains the full legal reserve for the protection of policyholders everywhere.

Non-residents are as fully protected by the New York Insurance Department as though they were residents of that State.

The POSTAL LIFE has been thus

transacting business since 1905, but it has not taken that long to prove the soundness and efficiency of the Company's non-agency method.

This method has also been followed by a leading English company for more than 100 years; the latter company is one of the very best insurance institutions in the world; it has never paid a penny of commissions to an agent; its policyholders receive the benefit, as in the case of the POSTAL LIFE.

"I will pay you to find out just what the POSTAL will save you personally—the first year and every other. Simply write and say:

Mail insurance particulars for my age as mentioned in the SCIENTIFIC AMERICAN for April 13



Postal Life Building

Your request involves no obligation and the POSTAL will send no agent to visit you: it dispenses with agents; you deal direct: the Company pays you the agent's commission.

Address, giving occupation and exact date of birth,

POSTAL LIFE INSURANCE COMPANY

The Only Non-Agency Company in America
WM R. MALONE, President
35 Nassau St., New York

STRONG POSTAL POINTS

First: Old-line legal-reserve insurance—not fraternal or assessment.

Second: Standard policy reserves, now more than \$10,000,000. Insurance in force more than \$60,000,000.

Third: Standard policy provisions, approved by the State Insurance Department.

Fourth: Operates under strict State requirements and subject to the United States postal authorities.

Fifth: High medical standards in the selection of risks.

Sixth: Policyholders' Health Bureau arranges one free medical examination each year, if desired.

A HOME-MADE 100-MILE WIRELESS TELEGRAPH SET

Read Scientific American Supplement 1605 for a thorough, clear description, by A. Frederick Collins. Numerous adequate diagrams accompany the text. Price, 10 cents, by mail. Order from your newsdealer or Munn & Co., Inc., 361 Broadway, N.Y.

Every man who works with tools knows the intense satisfaction of a keen even edge.

Every man who has ever used a

CARBORUNDUM

Sharpening Stone

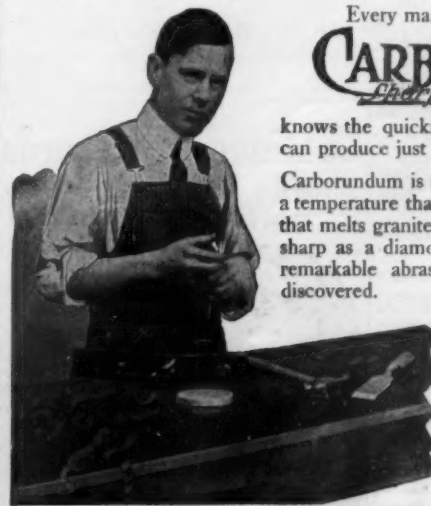
knows the quickness and ease with which he can produce just that kind of a satisfying edge.

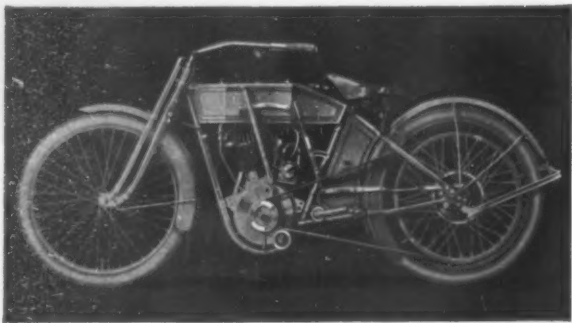
Carborundum is made in an electric furnace at a temperature that will turn steel to vapor and that melts granite rocks. It is as hard and as sharp as a diamond. Consequently the most remarkable abrasive material that was ever discovered.

Made into sharpening stones of all sizes and grits for sharpening any edge tool from a razor to an ax.

Ask your hardware dealer especially for No. 107-P—the round combination stone for carpenter's tools—or write for it direct. The price is \$1.00.

The Carborundum Company
Niagara Falls, N. Y.





Harley-Davidson

THE MOTORCYCLE WITH THE NEW WAY OF STARTING

No running alongside or tiresome pedaling needed to start the new Harley-Davidson. Just start the motor and at your convenience mount the machine, push forward the lever of the **Free-wheel Control** (a new and exclusive Harley-Davidson feature) and glide away. Unlike the ordinary motorcycle clutch the action of the Free-wheel Control is semi-automatic, thus preventing killing of the engine. The Free-wheel Control friction surfaces are nearly twice that of the ordinary motorcycle clutch and therefore are practically indestructible.

RIDES LIKE A TOURING CAR

The **Full-Holding Seat** (another new and exclusive feature) does away entirely with the jolts, jars, bumps and vibrations due to crossings, bad roads, cobblestone pavements, etc. The weight of the rider is held in suspension or floated between two long, heavy, concealed springs held under heavy compression. This device is in addition to all the shock absorbing provisions of the ordinary motorcycle and permits a range of action of nearly four inches as against the scant one inch of the ordinary motorcycle.

RUNS EXTREMELY QUIET

These newest models deserve the name "The Silent Gray Fellows." An extremely quiet motor combined with an exceptionally large muffler, makes this machine so quiet it cannot be heard across the street. These and other features of the new Harley-Davidson explained in our new booklet. Send for a copy or call on our nearest dealer.

HARLEY-DAVIDSON MOTOR CO.
237 B Street MILWAUKEE, WIS.



Ride an Indian Motorcycle this Summer. Its advantages are being enjoyed by thousands today. Ask any one of our 1200 agents to demonstrate the Indian. Learn its value to you, for vacation tours or regular trips.

The Indian's popularity is its best recommendation: "Count the Indians on the road!"

Free engine clutch, supplied with all 1912 Indian models, makes motorcycling as simple as bicycling. You move a lever and start from a standstill, without pedaling or running alongside.

4 H. P. Single Cylinder Indian, \$200
7 H. P. Twin Cylinder Indian, \$250

Write for free, descriptive catalog of 1912 Indians

The HENDEE MANUFACTURING CO.
(Largest Motorcycle Manufacturers in the World)
853 State Street, Springfield, Mass.

Chicago Denver San Francisco London

MASON'S NEW PAT. WHIP HOIST
for Outrigger hoists. Faster than Elevators, and hoist direct from teams. Saves handling at less expense.
Manufactured by VOLNEY W. MASON & CO., Inc.
Providence, R. I., U. S. A.

HELMET OIL LUBRICATES ANYTHING
118-124 North Clinton St.
CHICAGO, ILL. U.S.A.

Do you want good information cheap?

Write to us and we will refer you to a Scientific American Supplement that will give you the very data you need; when writing please state that you wish Supplement articles.

Scientific American Supplement articles are written by men who stand foremost in modern science and industry.

Each Scientific American Supplement costs only ten cents. But the information it contains may save you hundreds of dollars.

Send for a 1910 catalogue of Supplement articles. It costs nothing. Act on this suggestion.

MUNN & CO., Inc., Publishers
361 Broadway New York City

Continuous Records

of Pressure, Temperature, Electricity, Speed and Time are obtained automatically by means of



Bristol's Recording Instruments

Write for 64-page illustrated Condensed General Catalogue No. 160. The Recording Draft Gauge illustrated herewith is listed in Catalogue Section No. 1000 which will also be mailed upon request.

The Bristol Company, Waterbury, Conn.

nicked coil in the upper part of the glass cylinder; excess of water vapor condenses upon this coil and the drops are caught in a gutter directly under it and carried to the drinking trough at the bottom. The runway consists of a nickel netting placed over thick linen; the waste liquids are absorbed by the linen and drained off by a rubber tubing. The incubator is kept at a temperature of 38 deg. to 40 deg. Cent. (100 deg. to 104 deg. Fahr.).

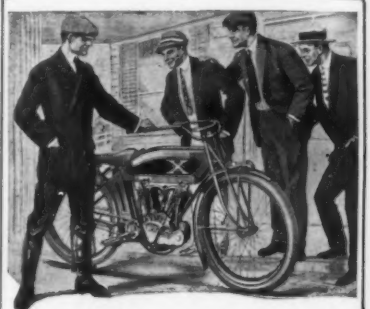
A cubical ante-chamber two feet high, made of sheet rubber, allows all necessary manipulations of the eggs to be carried on under strictly aseptic conditions. This is seen at the left of the figure. A mica window at the top and one at the end opposite the incubator permit the experimenter to look into this chamber. Thermometers suspended inside the glass cylinder and in the incubator indicate the temperature, and a self-registering thermometer is used to check these. In order to avoid all circulation of air and of dust, the apparatus is set in a room by itself, the doors and windows are guarded by double curtains, the uniform temperature is maintained by hot-air apparatus, the ventilation is secured by artificial means.

To begin an experiment, everything is first sterilized by means of steam under pressure. Then some corrosive sublimate is pulverized in the ante-chamber of the apparatus, the cooling-coil and the air current are shut off, and three or four eggs are carefully placed in the incubator. To show the method of manipulation, one side of the ante-chamber was removed before the photograph was taken. (See Fig. 1.) Here the hands of the experimenter, covered by the rubber gloves, are seen brushing the eggs with a solution of potassium permanganate in order to sterilize them. The eggs are placed in large glass tubes closed with cotton plugs, and from these they are transferred to the incubator without being exposed to the danger of becoming infected or contaminated in any way. After that the condenser and the ventilator are set in operation, as well as the constant vigilance of the experimenter, to prevent any accident from vitiating the results.

Within a few hours after breaking through their shells, the chicks leave the incubator and the next day they run about, peck at food and drink from their trough. (See Fig. 2.) Now Dr. Cohendy shows a tender solicitude for his charges, that they may grow well; he pays them frequent visits, makes them take exercise by startling them through the glass, so that they run back and forth in their cage, and watches the exchange of water and of gases. In another room he is in the meanwhile raising another brood of chickens under conditions as nearly like those of the experiment as possible, except that no sterilizations are carried on.

As a control of the aseptic conditions within the apparatus, culture tubes such as are used by bacteriologists are placed in the glass cylinder, and from time to time samples of droppings and dirt from the platform are placed in culture media. When the time of the experiment is over some chloroform is introduced into the air current and the chicks die without suffering. The bodies are immediately withdrawn and placed in sterilized bottles. In these they are weighed and then dismembered, the different parts being placed in various tubes containing various culture media, in order to get growth of whatever bacteria are present. (See Fig. 3.)

From the averages of the weights, from the observations made in the course of many autopsies and from thousands of microscopical examinations, Dr. Cohendy concludes that life without microbes is possible for the chicken, which normally has a rich bacterial flora in its intestine. The sterilized chickens were just as robust and just as active as the normal individuals; their feet, beaks, claws and feathers were just as well developed. One important difference was found in the digestive processes; the bacteria-free animals had better appetites, more frequent passages, and more voluminous dejecta. Not only did these chickens successfully survive the first critical weeks, during which it is believed that the gastric juice is incapable of withstanding microbes, but they proved themselves more resistant to cold, hunger, thirst and humidity. When they were finally exposed to infection by bacteria they showed no ill effects from several species which entered their digestive tracts in less than twenty-four hours. They still increased in size, became firm adults and reproduced nor-



Really a simple machine

If you're off on a pleasure jaunt, out on a business trip what you want is to relax in the saddle—to let the machine take care of itself and of you. And because that is what you want—you want the Excelsior. The Excelsior makes every trip a pleasure trip—no balks or tinkering troubles. The Excelsior is made of fewer parts than any other machine—the engine is put through a grueling test, under careful inspection, before it leaves our factory—everything is perfectly adjusted.

The Excelsior is really a simple machine. You needn't be a skilled mechanic or a chauffeur to handle it—anyone can understand and operate the Excelsior in less than 15 minutes. You'll never have a worry when you're on it—and the Kumfort Kusion seat post and perfected cradle spring fork make every road you ride a boulevard.

Nothing to spoil the keen enjoyment of every ride on your Excelsior—you can ride it to work in your business clothes.

EXCELSIOR Auto Cycle

The One Machine That Keeps You Clean

Of course there are other Excelsior features of superiority. We haven't overlooked a single thing. Your dealer will tell you.

Free—"You and the Motorcycle"

You don't really know what motorcycling is until you've read this breezy little booklet. Write for it. We'll also send our illustrated catalog.

EXCELSIOR MOTOR MFG. & SUPPLY CO.

Dept. C-2212-2262 Union St., CHICAGO



NEWCOMB CARBURETOR

gives a perfect mixture at all engine speeds

Insures easy starting, smooth working and maximum economy

Send for Booklet 16 S
The HOLTZER-CABOT ELECTRIC CO.
Chicago, Ill., Brookline, Mass.

VEEDER Counters

to register reciprocating movements or revolutions

Cut full size. Booklet free.

VEEDER MFG. CO.

10 Sargeant St., Hartford, Conn.

Cyclometers, Odometers, Tachometers, Counters and Fine Castings.

Represented in Great Britain by

MARLEY & CO., LIMITED, 6 City Road, Finsbury Square, London, E. C. 2.

France, by MARLEY & CO., LIMITED, 107 Avenue Fournier, Paris, Germany, Austria-Hungary and Scandinavia Countries by

LEWIS, LEWIS & CO., Hatten Strasse 17-20, Berlin.



Price \$1.00



AGENTS

Send for our proposition on the Hawthorne Four Cylinder Automobile Hand Air Pump.
HAWTHORNE MFG. CO., Inc.
38 Spruce Street, Bridgeport, Conn.



"RANGER" BICYCLES

Have imported roller chains, sprockets and

pedals; New Departure Coaster-Brakes and

Hubs; Puncture Proof Tires; Highest grade

equipment and many advanced features pos-

sessed by no other wheels. Guaranteed 5 yrs.

FACTORY PRICES direct to you

others ask for cheap wheels. Other reliable

made from 61¢ up. A few good second-

hand machines \$3 to \$5.

10 DAYS' FREE TRIAL on a

new, freight prepaid, anywhere in U. S.,

without a cent in advance. DO NOT BUY A

bicycle or a pair of tires from anyone at any

price until you get our big new catalog and

special prices and a marvelous new offer.

A postal brings everything. Write it now.

Tires Coaster Brake Rear Wheels, lamps,

parts, and sundries half usual prices.

Rider Agents everywhere are coming money selling our 4-

cycles, tires and sundries. Write today.

HEAD CYCLE CO., Dept. C-175 CHICAGO



HERE'S the greatest improvement in motorcycle construction—the *Thiem Two-speed Hub*. Turn of crank starts motor. A slight pressure on the low-gear pedal and you're off, steadily as an auto. Another pressure, and you are on high gear. Every variation of speed at your command. You can stop in congested traffic, in deep sand, or in the middle of steepest hills and restart without dismounting or pedalling.

The first and only proven

Two-speed Motorcycle

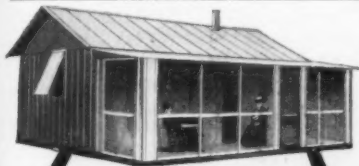
Nine years of grueling road service has proved the success of the *Thiem Two-speed Hub*. In use on 90% of European motorcycles for years. No other American machine has it. This advantage with many other exclusive features puts the Thiem years in the lead. *Duplex Three-way Carburetor* permits 25% saving of gasoline—handle bar control enables you to keep your hands on handle bar at all times—*patented Cushion Spring Seat and Forks* absorb all jars and shocks. The most noiseless, most comfortable and cleanest of Motorcycles. Let us prove the truth of these strong statements.

Write for Catalog

which describes many exclusive improvements. Prices \$145 to \$235. 25% lower than others.

JOERNS-THIEM MOTOR CO.
331 American National Bank Bldg., ST. PAUL

We have some open territory and an exceptionally strong proposition for a few high-class men to act as our Sales Representatives.



Portable Fireproof Bungalows

Stores, Construction Offices and Camps, Warehouses, Tool Shelters, Boat Houses, Garages, etc.

are built at low cost by the Pruden System of interlocking, self-structuring metal units.

Because portable, these buildings can be erected on rented property if desired. You and helper easily erect and as easily take down.

Pruden System Construction

solves the problem of fireproof construction at low cost. In successful use over three years. In no way experimental or amateurish but perfected in every detail. No framework needed. No wood used. Buildings shipped complete, in beautifully embossed units. Strong, durable and handsome as masonry. Appear to advantage amid finest surroundings.

Nothing ever devised equals the comfort, convenience, economy and safety of a summer cottage or other structure built by Pruden System Construction. No repairs or upkeep expense. No fire danger. No other construction like it. We own the patents and are sole manufacturers. Immediate shipments from stock. Send for Catalog of Pruden System Buildings mentioning in which particular building you are interested.

Metal Shelter Company

5-52 W. Water St., St. Paul, Minn.
Patentees and Sole Manufacturers of Pruden System Buildings

mally. The immunity against bacteria is thus shown to be not a matter of individual adaptation, but an inherited property.

It is of course impossible to say whether the facts found for the chicken are true for all back-boned animals, or even for all birds. Dr. Cohendy has under way plans for repeating these experiments with guinea pigs, and he will no doubt obtain results of great value. If the results of these experiments should show, as seems now very likely, that the constant associations between bacteria and higher animals are not essential to the welfare of the latter, but are, on the contrary injurious, though not fatal, we shall have another illustration of the unsoundness of assuming that "normal" conditions are necessarily the "fittest" for organisms.

The Real Fata Morgana

(Continued from page 335.)

1902, but includes several that he himself gathered by diligent correspondence. In 1902 Dr. Boccara, professor of physics at the Technical Institute at Reggio, published a memoir on the subject, in which he discussed all the earlier observations and three made by himself. Finally, in 1903, Giovanni Costanzo published what is no doubt the most important contribution to the descriptive side of the subject; but postponed, as the theme of a second memoir not yet published, the theoretical discussion of the phenomenon.

The last-named writer has collected, in a convenient table, abstracts of all available trustworthy descriptions of the Morgana, from that of Fazello (1558) down to the present time.

So far as we know, the Fa'a Morgana is not specifically mentioned by any writer before Fazello, although the phenomenon of mirage, in general, was well known to the ancients; while the name "Fata Morgana" has not been found, in this particular application, in any extant work before that of Marc' Antonio Polit (1617). In other uses the name is, of course, much older; for Morgan le Fay, the fairy sister of King Arthur, was a favorite theme of mediæval romance. The legend of this fairy, who dwelt in a marvelous palace under the sea, appears to have been carried to southern Italy by the Norman settlers in the 11th century. The phantoms of the Straits of Messina were subsequently alleged to be wrought by her enchantments for the purpose of luring mariners to destruction. According to this tale, the seaman would mistake the aerial city for a safe harbor, and would be led hopelessly astray in endeavoring to reach it. Hence this enchantress was the mediæval successor of Scylla and Charybdis, who also had their home in the Straits of Messina.

In 1671 Athanasius Kircher, the inventor of the magic-lantern, who had visited the Calabrian coast but had not himself seen the Fata Morgana, published a graphic description of the meteor from the pen of Father Angelucci, who saw it on Assumption Day, August 15th, 1634. Angelucci calls it a vision of Paradise, vouchsafed to him by the Virgin, and he says that he had heard for twenty-six years of this marvel but had not credited its existence, until he saw it with his own eyes and found it more wonderful than it had been described to him. He speaks of colossal colonnades, which he compares with the Roman aqueducts, and of rows of trees and towers, all of equal size.

Kircher explained these images as reflections from little crystalline fragments of rock and sand, floating in the air, and supposed that the soil of the Calabrian coast was peculiarly rich in materials likely to produce such an effect. In order to prove his hypothesis he took to Rome samples of this soil, placed them in a vessel shaped roughly like the passage between the Sicilian and Calabrian coasts, and applied heat to them; then, passing a ray of light through the hot air, he actually produced a mirage; the origin of which was, however, quite different from what he supposed, for his experiment would have been equally suc-

* Vittorio E. Boccara, "La Fata Morgana; studio storico-scientifico con appendice bibliografica," Mem. Soc. Spettroscopisti Ital., v. 31, 1902, pp. 199-218.

* Giovanni Costanzo, "La Fata Morgana; memoria prima," Mem. Pont. Acad. Nuovi Lincei, v. 21, 1903, pp. 101-123.



The Fabric that is SURE to meet with your Approval!

"Well, how is it, Mr. Tailor?"

"How do you like it?"

"It looks good to me. I'm sure the cloth is right because you can't go wrong on the American Woolen Co's Puritan Serge. It's becoming and it stands up. But you are the doctor as to fit and tailoring."

"Well, sir, I'm proud to say the work in that suit is worthy of the cloth. It's a pleasure to make a suit of Puritan Serge because, no matter how long it's worn, it's a credit to the workmanship put into it."

PURITAN SERGE

A thoroughbred style fabric for the man who cares

is one of the most beautiful rich shades of blue ever woven. It is a distinctive serge, with the warmth of sunlight in it, with a draping quality and feel that mark the true style fabric. Pure wool, through and through. Thoroughly dependable. Width 58-60 inches.—London shrunk.

Tell your tailor you want Puritan Serge. He has it or can get it. Puritan Serge is also used for high-grade ready-to-wear suits. The name **PURITAN SERGE** is stamped on the back of the cloth.

If unable to obtain Puritan Serge, send us the name of your clothier or tailor, with money order or check for quantity required at \$1.00 per yard (1 1/2 yards for man's suit), and you will be supplied through regular channels, as we do not sell at retail.

American Woolen Company
Wm. H. Wood, President.



Selling Agency

American Woolen Co. of N.Y.
AMERICAN WOOLEN BLDG.
4th Ave., 18th and 19th Streets
NEW YORK

THERE are imitations of "Porosknit" Underwear. But you can be sure of the GENUINE—for it alone has the actual "Porosknit" label and unconditional guarantee shown below—a guarantee with no time-limit or quibble. Read it.

The Genuine has this Label



and is **Guaranteed**

The absolute, exclusive guarantee is proof of quality, of durability. "Porosknit" is cool, light, elastic. "Porosknit" Union Suits are comfort idealized—no messy bulging at waist line—easy to button and unbutton—and stay buttoned.

For MEN
50c

All Styles
Shirts and Drawers, Each

For BOYS
25c

Union Suits, \$1.00 for Men; 50c for Boys

Write for booklet showing Styles

CHALMERS' KNITTING COMPANY, 79 Washington St., Amsterdam, N.Y.

Chalmers Guarantee

If, in your opinion, this garment, labeled as below,

Be Sure It Has This Label

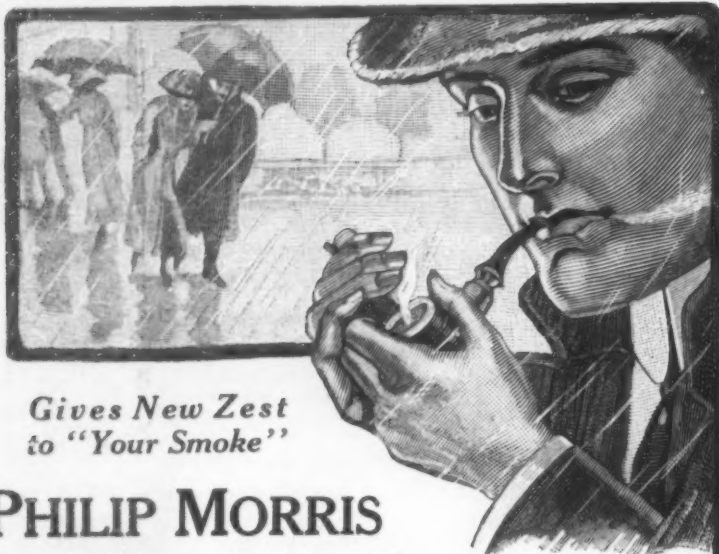


It Means Genuine "Porosknit"

fails to give you its cost value in underwear satisfaction, return it direct to us and we will replace it or refund your money, including postage. This guarantee applies to every genuine "Porosknit" garment not stamped "Seconds" or "Imperfect" across the "Porosknit" Label.

Chalmers Knitting Company, Amsterdam, New York

Handled by Good Dealers Everywhere



Gives New Zest
to "Your Smoke"

PHILIP MORRIS English Mixture and Cut Plug

23 Smokes in each 25c tin—every smoke the equal of an expensive cigar.

Other pipe tobaccos are not like "P. M." because others are not made by our exclusive scientific treatment of the finest tobacco leaf—nor with our extreme precautions as to cleanliness.

The English are most particular about tobacco, and the most particular Englishmen are daily enjoying the soothing sensation, fragrant aroma and agreeable taste of PHILIP MORRIS English Mixture and Cut Plug.



For pure pleasure, compare a "P. M." pipeful with your "favorite" cigar—the experience will save you many dollars and costs but a quarter.

Philip Morris English Mixture sells for \$2.00 a pound in 25c, 50c and \$1.00 tins.

Mail the 25c tin us, if your dealer cannot supply you.

PHILIP MORRIS CO., Ltd.
413 West Broadway, New York

Special Gloves for Motoring and Recreation

Here are cool, comfortable gloves especially built for motoring, golfing, hunting, camping, fishing and all outdoor fun. They are ventilated, keeping the hands cool in warm weather.

Grinnell Gloves

are soft and flexible and because made of real velvet coltskin. Give a firm, non-slip grip on a steering wheel, golf club, gun or paddle. When soiled they are washable in soap and water or gasoline, drying out soft as new. They wear like iron and never harden, crack, peel or shrink.

Pair On Approval

See Grinnell Gloves at your dealers. If he doesn't handle them, write us his name and tell us the size and style of gloves you wish, and color—black, grey or tan. We'll send a pair on approval, prepaid.

Style Book and Leather Samples on Request
Morrison-Ricker Mfg. Company
131 Broad St., Grinnell, Ia.



The
Shirt
of a
Gentleman



A man who buys **GOTHAM** Color-Fast SHIRTS gets what he wants. \$1.00, \$1.50 and up. Also Summer Underwear, Pajamas and Soft Collars

Your signed copy of the Gotham book on request.

GOTHAM Mfg. Co., Dept. 2, 200 5th Ave., New York City

All Steel Railroad Cars

EDITORIAL IN N. Y. JOURNAL

"The Pennsylvania Railroad was first to put the all-steel trains of cars in service on its fast express trains between New York and Chicago. Now the Pennsylvania runs only steel cars into its New York station."

cessful without the fragments of rock. Kircher later repeated this experiment, with some elaborations, before a brilliant assemblage of cardinals and other ecclesiastics. This time he threw multiple images of figures representing moving warriors and devils upon a screen; the appearance of which was so terrifying and mysterious that many of the spectators fled from the hall in consternation at "Kircher's magic."

The next noteworthy description of the Fata Morgana was Minasi's, which has already been mentioned. One of the clearest descriptions is that of Pietro Ribaud, French vice-consul at Messina, who saw the Fata Morgana from Catona, directly opposite Messina; i. e., some miles north of Reggio, where the phenomenon has usually been observed. Ribaud had crossed the straits many times in the hope of getting a glimpse of the Fata Morgana, and at length one morning he was rewarded. There had been a mist over the water, hiding the Sicilian shore; a condition that frequently precedes the Fata Morgana. Ribaud describes the mist as becoming "clear" and "crystalline," and then appeared multiplied and rapidly changing images of palaces, towers, arches, trees, and finally, mingled with them, ships, which were undoubtedly those lying at anchor in the harbor of Messina.

Passing over several other descriptions, we come to those of Dr. Boccara, who saw the phenomenon three times. His sketches of an aerial Morgana, in two of its stages, are presented in Figs. 1 and 2. Here we are looking northward from Reggio; to the right is seen the point of Catona, on the Calabrian side, while the mountainous shore occupying the rest of the horizon is that of Sicily. Fig. 1 shows the streak of white mist that so often ushers in the Morgana, already beginning to assume the shape of a phantom city, while Fig. 2 shows the phenomenon fully developed; the distant coasts have apparently moved forward, and vague, distorted images of the buildings of Messina, on the Sicilian coast, appear to rise from the water.

Dr. Boccara also describes a marine Morgana, seen by himself and Prof. Puccini, from different points of observation. In this case there was first the usual white mist; then appeared, apparently beneath the water, a long series of arches and pillars, which were evidently the images of a railway viaduct on the opposite shore. According to Puccini, these images in the water were in their ordinary position; i. e., not inverted, as in the case of a simple reflection.

Finally, Dr. Boccara has drawn a picture (Fig. 3) of a multiple Morgana which he did not see himself, but which was described to him by several eyewitnesses.

Summing up all the existing descriptions of the Fata Morgana, let us now endeavor to get a clear idea of the conditions under which this meteor arises, and of the appearance it presents to a spectator situated at or near Reggio.

The phenomenon occurs chiefly in summer, and when the weather is unusually hot; it is seen only in the forepart of the day, the time ranging from sunrise to two o'clock in the afternoon; the air and the sea must be calm, or nearly so; the sky cloudless. At first there is often a mist over the water, sometimes heavy enough to blot out the opposite shores. When these shores appear, they seem to have been moved forward toward the observer. All objects are more or less distorted; sometimes they are elongated vertically, sometimes horizontally. Often a multitude of images of a single object are seen, arranged either irregularly or in a horizontal row; rarely they are multiplied vertically (Fig. 3). The picture undergoes incessant changes; objects appear and disappear, or move from place to place. Sometimes the whole spectacle appears to be a reflection in the water; though, under ordinary conditions, no such reflection of the opposite coast is seen, as the latter is much too far from the observer.

In all these phenomena we see merely different manifestations of what is called mirage. The narrow and tortuous Straits of Messina are bordered on either side by lofty hills. This body of water therefore forms a sort of pocket, in which

*See a similar experiment for producing artificial mirage described and figured in R. W. Wood's "Physical Optics," 1st ed., 1905, p. 70.

"STAR" Large Line of Attachments
For Foot LATHES or Power LATHES
Suitable for fine accurate work in the repair shop, garage, tool room and machine shop.
Send for Catalogue B
SENECA FALLS MFG. CO.
695 Water Street
Seneca Falls, N. Y., U.S.A.

SEBASTIAN LATHES
9 to 15 Inch Swing
High Quality Low Prices Catalog Free
THE SEBASTIAN LATHE CO., 120 Calvert St., Cincinnati, O.

WORK SHOPS

of Wood and Metal Workers, without steam power, equipped with
BARNES' Foot Power MACHINERY
allow lower bids on jobs and give greater profit on the work. Machines sent on trial if desired. Catalog free.
W. F. & JNO. BARNES CO.
1999 Ruby Street Established 1872. Rockford, Illinois

IMPROVED Combination LATHE
for mechanics, model makers, experimenters and amateurs. Hollow steel spindle. The foot motion is of the improved grasshopper type. Circular saw has iron saw table perfectly adjusted. Guide and slide move to and fro readily, and are always true to the saw. Slide may be set at any angle. \$45, \$50, \$55 and \$60.
A. J. WILKINSON & CO.
Machinery, etc.
184-188 Washington St. BOSTON, MASS.

SOUTH BEND LATHES
Screw Cutting
9 to 13-inch Swing
Power, Foot & Electric Drive
Interesting Catalog Free
South Bend Machine Tool Co., 421 Madison St., South Bend, Ind.

A BENCH LATHE
for Amateurs, Experimenters, Model Makers, Etc.
Swing 7 inches, between centers 12 inches
Get Free "Lathe Talk" booklet
GODELL-PHATT CO. Toolsmiths Greenfield, Mass.

Ideal Lawn Mower Grinder
1912 MODEL NOW READY
Better than ever before. Grinds all makes of Mowers perfectly in 15 minutes without removing reel-knives or straight blades. Reel-bearing is operated by hand or power. SEND TO-DAY for full description of this wonderful labor-saver and money-saver. Will more than pay for itself first season because it does the work so much quicker and better. Skate Sharpener Attachment for sharpening skates. Over 5,000 in use. Fully warranted. Sold on easy-payment terms. Write-to-day. Don't delay.
HEATH FOUNDRY & MFG. CO., Plymouth, O.

Do you use GRINDSTONES?
If so we can supply you. All sizes mounted and unmounted, always kept in stock. Remember we make a specialty of selecting stones for all special purposes. Send for catalog I.
THE CLEVELAND STONE CO.
6th Floor, Hickox Building, Cleveland, Ohio

WANTED To manufacture METAL SPECIALTIES, 20 years experience in making Dies, Tools and Special Machinery. Expert work. Complete equipment. NATIONAL STAMPING & ELECTRIC WORKS Dept. 2, 412 So. Clinton Street, Chicago, Ill.

Experimental & Model Work
Circular and Advice Free
Wm. Gardam & Son, 82-86 Park Place, N. Y.

DIES, FINE TOOLS SPECIAL MACHINERY
METAL SPECIALTIES INVENTIONS PERFECTED
MOORE & CO., Indiana & Frank, In St. Chicago

Experimental and Model Work
Automobile and Marine Engine Repairs. Special Machinery Designed and Built. Private Enclosures for Experiments.
QUEENS CO. MACHINE WORKS
50-54 Summerfield St. Brooklyn, N. Y.

MODELS CHICAGO MODEL WORKS
ESTABLISHED 1892 165 W. MADISON ST. CHICAGO, ILL.
FOR CATALOGUE OF MODEL SUPPLIES

ICE MACHINES Corliss Engines, Brewers and Bottlers' Machinery
The VILTER MFG. CO.
899 Clinton Street, Milwaukee, Wis.

THE SCHWERTLE STAMP CO.
STEEL STAMPS LETTERS & FIGURES.
BRIDGEPORT CONN.



Test for the Pittsburgh Fire Department, November 16, 1911. 10 pounds of cotton waste, saturated with one and one-half gallons of gasoline. Fire extinguished in one minute with Pyrene.

Factory Waste

¶ Much of the lost motion in factories is not due to an improper assembling plan, but to the small fires that occur in waste material and electrical equipment. The Pyrene Fire Extinguisher will combat these fires successfully. Pyrene will not damage electrical equipment. It is effective even on fires occurring in highly inflammable material, like gasoline or oil soaked waste.

¶ At every danger point in your factory place Pyrene Extinguishers. They will suggest to your employees at once the proper means of fighting fire.

¶ Pyrene is safe, sure and easily operated. An extinguisher weighs only five pounds filled, is 14 inches long and 3 inches in diameter. Price, \$6.00 in enamel, \$7.00 in solid brass, and \$8.00 full nickel plated.

Pyrene Manufacturing Co.
1358 Broadway, New York City

SELLING COMPANIES

Pyrene Mfg. Co. Sales Divisions: 401 Astor Bldg., Atlantic City, N.J.; The Pyrene Mfg. Co., of Baltimore, Md.; 114 Keyser Bldg., Baltimore, Md.; Pyrene Co. of Illinois, 29 S. La Salle St., Chicago; The Pyrene Co., 23 S. Jefferson St., Dayton, O.; Pyrene Co. of New England, 116 Federal St., Boston; Pyrene Sales Company, 3029 Jackson Ave., Pittsburgh, Pa.; 609 Harrison Bldg., Philadelphia, Pa.; The Pyrene Co. of Missouri, 223 Pine Bldg., St. Louis, Mo.

If you are interested in a Simple, Safe and Successful protection against Fire of any nature whatsoever, mail us your name for an interesting free booklet. Dept. 1.

Your Name _____

P. O. Address _____

From _____

State _____

the circulation of air is impeded. Under strong sunshine the stagnant air presents strong contrasts of temperature, and therefore of density and refractive index, in a vertical direction; while in a horizontal direction there are even greater, though more gradual, contrasts, since in the morning hours the Calabrian side of the strait is under the shadow of the hills while the Sicilian side is in full sunshine. In short, conditions are favorable for superior, inferior and lateral refraction, three phenomena by no means peculiar to the Straits of Messina. Moreover, a multitude of little air currents are set up, tending to mix adjacent bodies of air of different temperatures. These currents explain the kaleidoscopic changes in the appearance of the Morgana. The spectator is looking through an atmosphere the density of which, at any point, is continually changing. Pernter compares this process to the effect produced by holding before the eye a sheet of inferior window-glass, full of "bubbles." If you view the landscape through such a sheet of glass, and at the same time move the latter from side to side, the same distortions and rapid changes are seen that appear to be characteristic of the Fata Morgana. Objects appear and disappear; and, if the glass be poor enough from the glazier's point of view, there will also be a multiplication of images; several rays from a single point coming to the eye by different paths through the glass.

Thus, in a general way, the Fata Morgana is explained; but there are still some unsettled questions to which students of this phenomenon may profitably devote their attention. Why is the Morgana so rare? One would expect the conditions described above to occur over this body of water almost daily, in hot and quiet weather. The typical marine Morgana is commonly supposed to be merely a case of inferior mirage—the common mirage of the desert—but if this is true the images seen in the water should appear inverted. However, some observers—notably Puccini—have explicitly described them as erect. Does the reflection of the railway viaduct lie beneath the object itself? Boccara and Puccini do not answer this important question. If the reflection lies, not directly beneath, but well to one side of the real viaduct, as Pernter has conjectured, then we have to do with lateral mirage, which involves no inversion.

Pernter believes that the white mist, so often described as accompanying the mirage, is in part an illusion. The observer beholds, through a quivering atmosphere, the shifting outlines of distant objects, and their aspect gives him much the same impression as if he were looking through a fog. That a real mist often precedes the phenomenon cannot be doubted, but it is probably nearly or quite dissipated when the Morgana becomes visible.

More or less similar phenomena of course occur in all parts of the world; in fact, one may see a mirage any day by looking through the stratum of air overlying a hot stove, or adjacent to the side of a wall heated in the sunshine.

While it is not our purpose to enter into a general description of mirage, we cannot refrain from quoting here an account of the phenomenon known as "Mutate," which occurs in another part of southern Italy, since we find here evidence confirming Minasi's often-disputed observation of the "iridescent Morgana." Pernter and Costanzo both describe the "Mutate," but the fact that an account of this phenomenon was given by an English traveler, many years ago, appears to be unknown to contemporary writers on optics. The following note on "Fata Morgana in the Japygian Peninsula" was published in "Notes and Queries," 3d series, vol. 12, 1867, over the signature of C. T. Ramage:

"Have travellers in Italy found this natural phenomenon (the Fata Morgana) anywhere else than at the Straits of Messina? In travelling over the Japygian peninsula I heard the natives speak of what they called 'Mutate,' and on questioning them as to what they meant I found that this was only another name for what is known as the 'Fata Morgana.' At Nardo and Galateo, and more particularly at Menduria, they assured

cf. Tennyson's description of a landscape "winking through the heat."

RICE'S MILL WHITE

"The Paint that Brims Over with Sunlight"

This paint, made by a secret process, will give much better results in your plant

Let us tell you why it gives from 19 to 36 per cent. more light, decreasing cost of artificial light—why it is most sanitary—why it will not flake nor scale—why it stays white longest—why it spreads more easily—why it is used by hundreds of leading industrial plants.

If you have 20,000 or more square feet of ceiling and wall space to cover, write us on your letter-head and we will send you free a sample board showing the tile-like surface of Rice's Mill White and our booklet, "A Clean Plant."

Address Department E.
U. S. GUTTA PERCHA PAINT CO.
Providence, R. I.
Originators of the Mill White Idea



"VICTOR" Electric Stationary Vacuum Cleaners

You can install it yourself in two hours time. Positive, noiseless, valveless, Vacuum Pump.

Also special Stationary for Country Homes, to be used with Gasoline Engine.

The VICTOR Electric Portable—"the finest in the land." Buy direct and save money. Booklet.

VICTOR CLEANER COMPANY, Manufacturers, York, Pa.

It's all in the angle!



The clean, smooth, slanting stroke that meets and cuts the beard at an angle, without pulling or scraping—the stroke of the expert barber—is the natural stroke of the Young, and the "any angle" feature does it. The

Young Any-Angle Razor

is the diagonal stroke made safe. It shaves clean, it shaves quick and shaves with absolute safety. It shaves the way the experienced barber shaves and with an edge as keen. But with the barber it is *expertness*; with you it is the Young Razor and its "angle" feature. A touch tilts the blade, so that a straight pull on the handle produces a slanting stroke with the blade.

There is nothing to learn—the skill is in the razor.

Try the slanting stroke shave with a Young Razor. You will find the blades as keen and as smooth-cutting as the finest tempered steel, carefully ground, honed, and stropped, can make them. You will find the razor itself the lightest, handiest, simplest, and most nicely balanced of any you have ever used.

30 Day Trial

Dealers are authorized to take back the Young and refund the purchase price if after using it thirty days you wish to return it. If your dealer cannot supply you, send \$3.00 to us, with same return privilege. Price, including 12 keen blades, with genuine leather case

\$3.00



Young Safety Razor Co., 1741 Germantown Avenue, Philadelphia, Pa.

Break all Records on Low Cost of Hauling

Motz Cushion Tires in Test of Efficiency Eclipse Both Pneumatic and Solid Tires

You know Motz Cushion Tires are trouble-proof.

You know they are easy-riding. But do you realize that any motor car, on a given charge of fuel, will travel farther equipped with MOTZ TIRES than with pneumatic or solid tires?

It's a fact. Makes no difference whether your car is electric driven or gas driven, —or what make it is —or what kind of light delivery duty it performs —or what kind of streets it is driven on —or what kind of tires you are now using.

—put Motz Cushion Tires on it and you will get more miles' service per battery charge or per gallon of gasoline than you ever got before.

You'll get more miles of tire service, too! You'll get a guarantee of 10,000 miles —two years.

And you won't ever be bothered by punctures, blow outs or rim-outs. You won't have to carry an extra tire, either.

And the mechanical parts of your car will get the same protection from bumps and jolts as pneumatic tires give.

For Motz Cushion Tires are every whit as easy-riding as properly inflated pneumatic tires.

They have double, notched treads, which prevent skidding and distribute weight to the side. The undercut sides allow free action of bridges. The slantwise elastic bridges yield like air in pneumatic tires.

Note, too, that Motz Cushion Tires fit any standard clincher, universal-quick-detachable, or demountable rim.

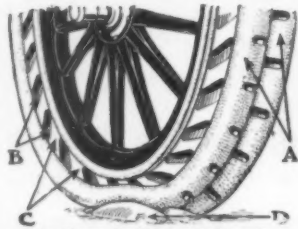
You have asked for an economical tire. Here it is. Economical in every sense. Gives utmost service with no repair expense—easy-riding and protects your car—gives low cost of hauling—is easy to apply.

What more could one ask or want? Write for our Booklet 93, mentioning make and model of your car and we will be pleased to give you the name of our nearest agent.

For heavy trucks, where load, not speed, is the principal factor, we recommend Motz Solid Tires on Demountable Rims.

MOTZ Cushion Tires

Best Equipment for Light Delivery Commercial Cars



A—Shows double, notched treads.
B—Shows undercut sides.
C—Shows slantwise bridges.
D—Shows absorbing means when passing over an obstruction.

(224)

THE MOTZ TIRE AND RUBBER COMPANY

Factories and Executive Offices, Akron, Ohio

BRANCHES: New York, 1737 Broadway; Chicago, 2023 Michigan Ave.; Detroit, 999 Woodward Ave.; Kansas City, 409 E. 15th St.

Standard Tire & Rubber Co., 104-106 Portland St., Boston, Mass., Distributors for the New England States

Santo Vacuum Cleaner

This is the Santo-Duplex Stationary Plant



This is the only stationary vacuum cleaner approved by the insurance underwriters and electric light companies for operation on ordinary lighting circuits. It is operated by a high-grade electric motor of only 1/4 h.p. and is started and stopped from floor. Cost of operation, less than 4 cents per hour. Complete tool equipment.

Manufacturers of the famous line of Santo Portable Electric Vacuum Cleaners, in different sizes, and at various prices.

KELLER MANUFACTURING CO.

Dept. S. A. PHILADELPHIA, PA.

SCIENTIFIC AND TECHNICAL BOOKS

WE HAVE IN PREPARATION A NEW CATALOG of scientific and technical books, which will be ready for distribution about April 15th. This catalog will contain the titles and descriptions of 3500 of the latest and best books covering the various branches of the useful arts and industries.

OUR "BOOK DEPARTMENT" CAN SUPPLY these books or any other scientific or technical books published, and forward them by mail or express prepaid to any address in the world on receipt of the regular advertised price.

SEND US YOUR NAME AND ADDRESS, AND A copy of this catalog will be mailed to you, free of charge, just as soon as it is printed.

MUNN & CO., Inc., Publishers
SCIENTIFIC AMERICAN OFFICE
361 Broadway New York City



Magnificent Steel Launch \$96

Complete with Engine. Ready to Run

18, 20, 25 and 37 ft. boats at proportionate prices. All launches tested and fitted with Detroit two-cycle reversible engines with speed controlling lever—simplest engine made—starts without cranking—has only 3 moving parts—anyone can run it. The Safe Launch—absolutely non-skid—works on both sides. All boats fitted with six-light compass—cannot sink, leak or rust. We are sole owners of the patents for the manufacture of rolled steel, lock-seamed steel boats. Free Catalog. Steel Rowboats, \$20. (65)

MICHIGAN STEEL BOAT CO., 1332 Jefferson Avenue, Detroit, Mich., U.S.A.

me that at dawn, when the atmosphere is perfectly calm, or when a 'scirocco' is just beginning to blow, the appearances at times are very remarkable, exhibiting, if we can believe them, beautiful representations of castles, plains with cattle and flocks, men on horseback, and, what

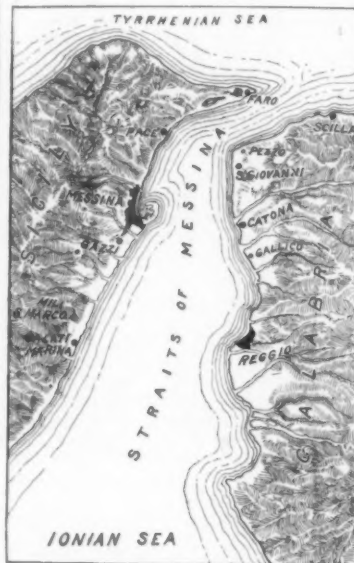


Fig. 5.—Map of the Straits of Messina, in which the Fata Morgana is observed.

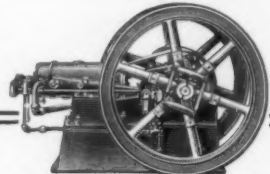
must be striking, the edges of the figures are often fringed with the prismatic colors. The figures are constantly changing, and hence no doubt the origin of the name 'Mutate' which the natives apply to it. I am not able to confirm this from personal observation, nor have I been able to find any mention of the phenomenon in any English work. The only allusion to it that I have seen is in Antonii de Ferrariis Galatell, *De Situ Japygiae Liber* (Lycell 1727)."

Let us hope that Italian men of science will continue the good work of Boccara and Costanzo, and that in a few years we shall have the precise measurements of air and water temperature, atmospheric pressure, angular dimensions and relative positions of the images seen, and the other detailed information necessary to a complete elucidation of the Fata Morgana. Probably good photographs of the Morgana could be made without difficulty, and they would be extremely useful.

Since the foregoing article was written Dr. F. A. Forel has published a simple and plausible explanation of the Fata Morgana frequently seen in the late spring and summer on Lake Geneva*. The phenomenon occurs in the afternoons of clear days, when there is little or no wind. The spectator beholds on the opposite shore of the lake a shifting band made up of rectangular sections of various shades and colors: now resembling a vast cliff bordering the shore; now the quays and blocks of a great city; in other words, just the appearances most frequently described in connection with the Morgana of the Straits of Messina.

At the time of year in question the general temperature of the air over the lake is lower than that of the water in the morning, but higher in the middle and late afternoon. The air immediately overlying the water, however, partakes of the temperature of the latter. Hence in the morning the lower strata of air are warmer than the upper; rays of light coming from objects on the distant shore follow a curved path, concave above; the objects appears to lie below their real level, i. e., the horizon is depressed. In the afternoon the conditions are reversed; the horizon is elevated. The Morgana represents the transition stage, when for a short time both forms of refraction occur at the same time. Some of the light-rays reach the eye from such an angle as to lift the apparent horizon; others depress it; and yet others show it in various intermediate positions. Thus the image of the opposite shore is broadened, and as the normal after-

* Comptes rendus, 27 novembre, 1911, p. 1054-1056; also more fully in Archives des sciences physiques et naturelles, Geneve, 15 décembre, 1911, p. 471-481.



ADVANTAGES OF GASOLINE ENGINES

As compared with steam power for units of moderate size, internal combustion engines have many advantages. Being more compact and simple, they are more easy to manage. Speed regulation is brought to a fine point in several types of

IHC Gasoline Engines which run at a variation of less than 2 per cent under all loads up to the maximum. When in these points are added the greater economy of the gasoline engine, the smaller amount of attention needed, the total shutting off of expense when the engine is stopped, the IHC gasoline engine is entitled to consideration when installing a power plant of anywhere up to 50-horse power.

Full information about IHC gasoline engines is contained in our six-page catalogue, which illustrates all the various styles—horizontal and vertical, air and water-cooled, stationary and portable. A post card brings it.

International Harvester Company of America
15 Harvester Building Chicago, U.S.A.

ELLIS

USE GASOLINE, KEROSENE OR DISTILLATE

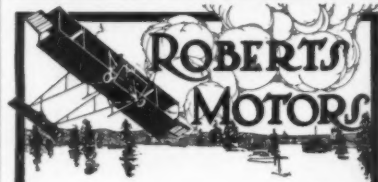
Develop more than rated power. Uniform speed. Governor adjustable while running. Force feed oiler. Sight feed fuel supply. Auto muffler. Steam engine throttle giving

THREE ENGINES IN ONE

Many other features. Sent on 30 days Free Trial with freight prepaid. No sale until satisfied. Ten year guarantee. Big new catalog FREE.

ELLIS ENGINE CO., 57 Mulford St., Detroit, Mich.

ENGINES



FOR BOATS & AEROPLANES
WRITE FOR CATALOG WANTED
The ROBERTS MOTOR CO., Sandusky, U.S.A.

ELECTRONS AND THE ELECTRONIC THEORY are discussed by Sir Oliver Lodge in Scientific American Supplements 1428, 1429, 1430, 1431, 1432, 1433, 1434. Price 10 cents each. For sale by Munn & Co., Inc., and all new dealers.

OIL DAG

Reg. U. S. Pat. Off.

This new lubricant improves combustion engine operation by building a graphite film that improves the fit between the piston rings and cylinder walls. While affording perfect lubrication, it cuts down the quantity of oil that enters the combustion chamber to cause carbon troubles. It affords increased power.

It is put up in concentrated form for charging 1, 5, 10 or 50 gallons of oil. You mix it with the oil you use regularly. Send for Bulletin L-556. International Acheson Graphite Co. Niagara Falls, N. Y. General Agents for Oiling, made by Acheson Oiling Company

SANDOW MARINE ENGINE

BUILT LIKE AN AUTOMOBILE ENGINE. 2 to 30 h.p., ready to ship; gasoline or kerosene. Drives boats of all kinds; starts easy; cannot backfire; almost noiseless, 5-Year Absolute Guarantee—30-Day Trial. Three moving parts—women and children run it. Demonstrate an engine for us and get yours at cost. Be first in territory to get offer. Detroit Motor Car Supply Co. Sales plan and 12 Helen Ave., DETROIT, MICH. Write today. Literature FREE.

Detroit Marine Engine

Uses Gasoline or Kerosene. Demonstrator Agent wanted in each boating community. Special wholesale price on first order. Amazing fuel injector saves HALF operating cost. Gives more power, will not back-fire. Engine starts without cranking; reversible; only three moving parts. Detroit Engine Works, 1332 Jefferson Avenue, Detroit, Mich.



Buffalo Marine Engines

combine endurance, speed and simplicity of operation. They are built in 20 sizes—3 to 125 h.p.—for launches, speed boats, cruisers and work boats. They operate on gasoline, kerosene or distillate.

Buffalo Gasoline Motor Co. 1300-1310 Niagara Street, Buffalo, N. Y.

"Y and E" Salesmen
solve filing problems
every day.

Use their knowledge in
perfecting your office sys-
tems. Costs nothing—
goes with the equipment.

Branches: New York, Philadel-
phia, Chicago, Boston, Pittsburg,
Washington, Buffalo, Cleveland,
San Francisco, Los Angeles.
Agencies everywhere.



448 St. Paul St. Rochester, N. Y.

SELENIUM AND ITS REMARKABLE
PROPERTIES are fully described in Scientific
American Supplement 1430. The paper is illustrated
by numerous engravings. Price 10 cents. For sale
by Munn & Co., Inc., and all newsdealers.



AROUND THE WORLD by the palatial cruising steamship Victoria Luise

16,500 tons

From New York - Nov. 12, 1912

From San Francisco - Feb. 27, 1913

110 days - \$650 and up
Including all necessary expenses
aboard and ashore, railway, hotel,
shore excursions, carriages, guides,
fees, etc.

Write for beautifully illustrated
booklet containing full information.

Summer Cruises

To Land of the Midnight Sun
NORWAY, NORTH
CAPE, SPITZBERGEN

8 cruises from Hamburg dur-
ing June, July and August.
Duration from 14 to 16 days.
Cost \$62.50 up. By the large
cruising ships Victoria Luise,
Kronprinzessin Cecilie and
Meteor.

Jamaica, Panama Canal

Cuba, Hayti, Colombia, Costa Rica.
Weekly sailings by "Prinz" and other
well known steamers.

To JAMAICA—\$75 round trip;
\$142.50, 25-day cruises; \$140
allowing two to three days on lethmus.
Optional shore excursions.

Write for booklet of any cruise.

HAMBURG-AMERICAN LINE

41-45 Broadway, N. Y.

Boston Philadelphia
Pittsburgh Chicago
San Francisco
St. Louis

noon conditions gradually establish them-
selves the distant picture undergoes var-
ious weird distortions.

This explanation appears to fit satis-
factorily at least certain broad features
of the Italian Fata Morgana.

Rules Governing the Competition for the \$15,000 Flying Ma- chine Prize Offered by Mr. Edwin Gould

1. A prize of \$15,000 has been offered
by Mr. Edwin Gould for the most perfect
and practicable heavier-than-air flying
machine, designed and demonstrated in
this country, and equipped with two or
more complete power plants (separate
motors and propellers), so connected that
any power plant may be operated inde-
pendently, or that they may be used to-
gether.

Conditions of Entry.

2. Competitors for the prize must file
with the Contest Committee complete
drawings and specifications of their ma-
chines, in which the arrangement of the
engines and propellers is clearly shown,
with the mechanism for throwing into or
out of gear one or all of the engines and
propellers. Such entry should be ad-
dressed to the Contest Committee of the
GOULD-SCIENTIFIC AMERICAN PRIZE, 361
Broadway, New York city. Each con-
testant, in formally entering his machine,
must specify its type (monoplane, biplane,
helicopter, etc.), give its principal dimen-
sions, the number and size of its motors
and propellers, its horse-power, fuel-carry-
ing capacity, and the nature of its steer-
ing and controlling devices.

3. Entries must be received at the office
of the SCIENTIFIC AMERICAN on or before
June 1st, 1912. Contests will take place
July 4th, 1912, and following days. At
least two machines must be entered in
the contest or the prize will not be
awarded.

Contest Committee.

4. The committee will consist of a rep-
resentative of the SCIENTIFIC AMERICAN,
a representative of the Aero Club of Amer-
ica, and the representative of some tech-
nical institute. This committee shall pass
upon the practicability and efficiency of
all the machines entered in competition,
and they shall also act as judges in de-
termining which machine has made the
best flights and complied with the tests
upon which the winning of the prize is
conditional. The decision of this com-
mittee shall be final.

Conditions of the Test.

5. Before making a flight each con-
testant or his agent must prove to the
satisfaction of the Contest Committee that
he is able to drive each engine and pro-
peller independently of the other or oth-
ers, and that he is able to couple up all
engines and propellers and drive them in
unison. No machine will be allowed to
compete unless it can fulfill these require-
ments to the satisfaction of the Contest
Committee. The prize shall not be award-
ed unless the competitor can demonstrate
that he is able to drive his machine in
a continuous flight over a designated
course; and for a period of at least one
hour he must run with one of his power
plants disconnected; also he must drive
his engines during said flight alternately
and together. Recording tachometers at-
tached to the motors can probably be used
to prove such performance.

In the judging of the performances of
the various machines, the questions of
stability, ease of control and safety will
also be taken into consideration by the
judges. The machine best fulfilling these
conditions shall be awarded the prize.

6. All heavier-than-air machines of any
type whatever, aeroplanes, helicopters,
ornithopters, etc., shall be entitled to
compete for the prize, but all machines
carrying a balloon or gas-containing en-
velope for purposes of support are ex-
cluded from the competition.

7. The flights will be made under rea-
sonable conditions of weather. The judges
will, at their discretion, order the flights
to begin at any time they may see fit,
provided they consider the weather con-
ditions sufficiently favorable.

8. No entry fee will be charged, but
the contestant must pay for the transpor-
tation of his machine to and from the field
of trial.

9. The place of holding the trial shall
be determined by the Contest Committee.

Colgate & Co have
21 of our trucks of
various load capaci-
ties, from 1 to 7 tons,
in service in New
York City alone.



Mack Saurer Hewitt

Proved by 12 years
of real service

Proved by 17 years
of real service

Proved by 10 years
of real service

"Leading gasoline trucks of the world"

Your transportation problem—you want unprejudiced
advice first; then service.

Who will best advise and serve you?

A manufacturer, who has only one kind of a truck
built in one or two sizes? Or the International Motor
Company, which manufactures trucks of value proved by
years of use; with various designs and distribution of
load and a full line of sizes with every kind of body built
in their own plant?

Capacities: 1, 1½, 2, 3, 4, 4½, 5, 6½, 7½ and 10 tons

You cannot afford to settle your transportation
problem without consulting this organization.

We have data on the transportation problems of about every line of business.
Our Engineering Department will be glad to send you, on request, special
information in regard to your own particular needs.

International Motor Company

General Offices
57th and Broadway New York

Works
Allentown Pa.; Plainfield N. J.

Sales and Service Stations
New York, Chicago, Philadelphia, St. Louis, Baltimore, Boston, Cleveland, Buffalo, Jersey City,
Atlanta, Kansas City, Denver, San Francisco, Los Angeles and other large cities

Lather

—lather that does not need to be
"rubbed-in" with the fingers

—lather that begins to soften your
beard as soon as it touches your face

—lather that leaves your face feeling clean, smooth
and refreshed

—good shaving lather for real shaving comfort—
that's

COLGATE'S SHAVING LATHER

No matter which method you use, Stick, Powder or Cream,
Colgate's Lather excels. It is softening, soothing and sanitary.
Analyses by eminent chemists prove it to be notably free
from uncombined alkali (the cause of "smart" and "burn").

Buy your choice of the Colgate Shaving Preparations
at your dealer's—or for a generous trial size of the
Stick, Powder or Cream send us 4 cents in stamps.



STICK

CREAM

POWDER

Chalmers

Ten Reasons Why You Should Buy a Chalmers Car

1 Chalmers cars are made in our own shops.

We build our own motors, transmissions, steering gears, control levers, axles, fenders, running boards and practically all other parts. We even have our own foundry. Our factory is one of the most completely equipped in the industry.

2 Chalmers engineering is right.

Our cars are designed under the direction of our consulting engineer, George W. Dunham, a recognized authority. His policy is to be progressive, but not radical; to be always in the lead, but never to use any construction that has not proved itself under severest tests.

3 Chalmers compressed air self-starter is the simplest, safest, most reliable.

This great convenience does away with the annoyance and danger of cranking. It is dependable. There is nothing complicated about it—just press a button on the dash and away goes your motor.

4 Chalmers four-forward-speed transmission gives utmost ease of control.

With this great improvement you can always select the speed that will carry you along—through any kind of going—in the fastest time and with the least strain on your motor. A feature of all the best foreign and most of the high-priced American makes.

5 Chalmers long stroke motor gives you all the power you will ever need.

This motor has great pulling power at low speeds. It "hangs on." It throttles down well and there is little danger of "stalling" it. It also has many other points of superiority—ball-bearing crank shaft, cylinders en bloc, improved water jackets, dual ignition, improved oiling system. It has also patented Chalmers piston rings to prevent smoking and loss of compression.

6 Chalmers cars are easy to handle.

No car could be more fascinating to drive. Consider the convenience of these features: self-starter; four-forward-speed transmission;

multiple disc clutch; demountable rims; automatic tire inflator; carburetor dash adjustment.

7 Chalmers cars are safe cars.

Note the four main factors of safety on a Chalmers: the heavy pressed steel frame; the sturdy second-growth hickory wheels; the quick-acting, powerful brakes; the forged steel steering connections. Compare the Chalmers with other cars from the standpoint of safety.

8 Chalmers service department is constantly at your call.

When you buy a Chalmers it is our aim to help you get satisfactory use and enjoyment of that car. For that purpose we maintain a well-organized Service Department. We have \$750,000 invested in parts at our plant and among our dealers, for your convenience in case of accidents.

9 Chalmers cars are sold at a fair price—one price to all.

Chalmers cars are not high-priced. Yet have always sold primarily on their quality rather than their price. And we believe no other cars offer quite so much value for the same prices or lower.

10 The Chalmers guarantee is backed by a strong, sound company.

We have over \$5,000,000 invested in this business. We have ample financial resources. We buy material and equipment at cash prices. We have the capital, the equipment, the organization to do business on a large scale—and do it right. More important still, we have the determination to see that our resources mean efficient service to the owners of Chalmers cars.

If you are going to buy a car this spring, we feel these Ten Reasons should convince you that it ought to be a Chalmers. In a Chalmers you get all you can ask in a motor car—at a medium price. We urge you to see these cars at our dealers' and place your order at once.

"30," \$1500; "Thirty-Six," \$1800; "Six," \$3250.

Chalmers Motor Company, Detroit, Mich.

2¢ A WEEK

A safe, very brilliant, powerful, steady, white light. Is better than electricity or acetylene and cheaper than kerosene.

Every lamp is a complete self-contained miniature light works. Clean—bright—odorless—portable. Made in over 80 styles for every purpose. Fully guaranteed. Catalog free. Agents wanted.

THE BEST LIGHT CO.
ST. E. 6th Street
Canton, O.

THE "BEST" LIGHT

The First Annual International Aeronautical Exhibition

Will be held
May 9th to 18th
at the

New Grand Central Palace
New York City

Under the auspices of
The Aero Club of America

Information regarding space for exhibits of Aeronautic Machines, Motors, Accessories, Models, etc., can be obtained from The Show Committee, Aero Club of America, 297 Madison Av., N.Y. City

SAVE YOUR BRAIN

Goldman's Handmade, Fast, Cheap, Accurate, Reliable, Portable, Durable, Reliable!

Carries automatically! Resets instantly! Adds, subtracts, multiplies, divides! Shortest method! Checking systems! Agents Wanted. Remorseless! Anthony & Co., 111 E. 20th St., N.Y.

Magical Apparatus

Grand Book Catalog. Over 700 engravings. 25c. Parlor Tricks Catalog Free.

MARTINKA & CO., Manufacturers, 463 Sixth Avenue, New York

LEARN TELEGRAPHY

MORSE and WIRELESS at home with OMNIGRAPH AUTOMATIC TRAINER in half usual time—trifling cost. Sends you messages without limit automatically—easily becomes expert. Price \$2.00. Catalog free. OMNIGRAPH MFG. CO., Dept. 16, 28 Cortlandt Street, New York.

TELESCOPES

W.D. MOORE
PLAINFIELD, N. J.

Learn Watchmaking

We teach thoroughly in as many months as it formerly took years. Does away with tedious apprenticeship. Money earned while studying. Positions secured. Easy terms. Send for catalog.

ST. LOUIS WATCHMAKING SCHOOL, St. Louis, Missouri

CRUDE ASBESTOS

DIRECT FROM MINES

PREPARED Asbestos Fibre for Manufacturers use

R. H. MARTIN
OFFICE, ST. PAUL BUILDING
220 Broadway, New York

TYPEWRITERS ALL MAKES

Visible Writers or otherwise L.C. SMITHS, UNDERWOODS, OLIVERS, Etc.

to 1/2 MFRS. PRICES

Shipped Anywhere for Free Trial or Rented, allowing Rent to Apply. First class Machines. Full Guarantee. Write Prices \$15.00 Up for Illustrated Catalog 10. Your opportunity. TYPEWRITER EMPORIUM (Est. 1899), 24-26 W. Lake St., CHICAGO

ELECTRIC MOTORS

Dynamos Grinders SPECIAL MACHINES Polishers

ROTH ELECTRIC MOTORS
198 Loomis Street, Chicago, Ill.

and the location of such place of trial shall be announced on or about June 1st, 1912.

10. Mr. Edwin Gould, Munn & Co., Inc., publishers of the SCIENTIFIC AMERICAN, and the judges who will be selected to pass upon machines, are not to be held responsible for any accident which may occur in storing or demonstrating the machines on the testing ground.

The Cleland Davis Aerial Gun

COMMANDER CLELAND DAVIS, U. S. N., of Washington, has invented a new gun with which to arm military aeroplanes. The gun is designed to destroy foes of the air or to attack an enemy on earth from a height where gun, gunner and aeroplane will be an almost invisible target.

The new gun fires a 33-pound projectile and has no perceptible recoil. A powerful recoil would capsize the flying carriage. The gun has another feature which adds materially to its practical value. It is made of vanadium steel, and although twelve feet long, weighs only 150 pounds. This is an inconsiderable weight, for the aeroplanes of this day can carry four, five and even six passengers. One of the large English or German military airships could easily carry a battery of these guns. The gun discharges a projectile at an initial velocity of more than 1,000 feet a second.

In a test held on a barge off Fisher's Island, N. Y., several United States military and naval officers were present. The gun was mounted on steel springs. It was fired twice and although the springs were of delicate mold there was no recoil after either discharge. The test was in every way satisfactory and arrangements are now being made by the Show Committee of the Aero Salon, at the New Grand Central Palace, May 9th to 18th, to make the gun one of the features of the historic exhibit of the show.

Liability to Sickness

THE liability to sickness varies with the occupation. In Germany, out of every 100 workers between 15 and 60 years of age, there fall ill on the average, of storekeepers' assistants, 4; tailors, 56; shoemakers, turners, saddlers, and leather dealers, each, 59; butchers, 64; gold and silver workers, 65; carpenters and wheelwrights, 68; glove-makers (male), 71; bakers and confectioners, each, 74; blacksmiths and locksmiths, each, 79; coachmen, textile workers and book-binders, each, 80; small printers, 84; glove manufacturers, 86; glove-makers (female), female workers in cement works, 92; female textile workers, 93; clay and porcelain workers, 94; builders' workmen, 95; brickmakers, male workers in match factories, and cement works, each, 102; furnace workers in match factories, 103; large printers, 104; leather manufacturers, 105; female clay and porcelain workers, 106; female workers in wooden ware factories, 108; tobacco workers, 109; glass blowers, 112; workers in sugar refineries, 126; in paper mills, 130; on heating and lighting apparatus, 132; iron and metal workers, 137; brewers, distillers, and railway workmen, 142; workers in chemical factories, 170; miners, 184.

A New Gas Lamp

AN unusually high candle power for city lighting is obtained with the new Gretzine gas burners, these being of the gas mantle type, but having the gas delivered under pressure by special piping. The new system is being tried by the municipality of Paris on the Boulevard Raspail and the Rue Monge, with high poles resembling arc light poles. The light is very brilliant and gives a better and more evenly distributed illumination than the usual gas lamp post, and the superiority over the latter is quite marked. Several mantle burners are grouped together in one large globe, and the whole has a brightness resembling that of an arc light. Seeing that with the ordinary gas mantle burner the illumination per square inch surface of the mantle depends upon the temperature, and this in turn cannot go above what has been heretofore the limit, it was desired to increase the temperature and thus obtain a brighter light. The problem was solved by delivering the gas under pressure to special mains by means of compressors, so that now the mantle works at a higher heat.

We Guarantee Utica Pliers

Because we know that they will do. Every plier that leaves our factory receives a most rigid test and inspection.



We have traced Utica Pliers that have been in use eight and ten years and are still doing good service. That's one of the reasons why we guarantee Utica Pliers. If you are skeptical try one at our expense and if you are not satisfied we will refund your money. Don't accept a substitute.

WRITE FOR PLIER PALMISTRY.

UTICA PLIERS ARE UNION MADE.

UTICA DROP FORGE & TOOL CO.
Utica, New York. Dept. D.

RAILROAD AND INDUSTRIAL Preferred and Common Stocks

(Listed on New York Stock Exchange)
purchased to yield 7% or better on sums of
\$100 to \$10,000
with opportunity for further profit under our
Semi-Investment Plan
Descriptive 32-page booklet relating to this plan of purchasing and other matters pertaining to investments
FREE UPON REQUEST

Leavitt & Grant
Established 1903
Members Consolidated Stock Exchange of N. Y.
55 Broadway New York

Make \$200 a Month with the 1912 Camera Sensation



Six entirely different style pictures, including Post Cards instantly developed. No experience needed. My New Model Camera is the sensation of the Camera world. With it you can take and instantly develop before the very face and eyes of enthusiastic customers, six entirely different style pictures, including POST CARDS, four styles of Tintype Pictures and Brooch Pictures. You can take either one person or as many as seven persons in one group. The demand for photographs is universal. Not the slightest experience is required, and I send with the outfit everything ready to begin work with. The Camera comes to you complete and you begin making money the very first day it arrives on any street corner, or wherever people gather. All you have to do is to set the machine up and the money starts pouring into your pocket at once.

\$15.00 complete with Tripod, 25 Buttons and Frames, 25 Tintypes and Mounts (2 1/2 x 3 1/2), 25 Tintypes and Mounts (1 1/2 x 2 1/2), 25 Post Cards, 1 bottle Liquid Developer.

Positive proofs of the money-making certainties with this outfit, yours for the asking. Let me make you a special introductory offer.

L. E. LASCELLE, Mgr., 627 W. 43rd St., Dept. 316, New York

Automatic Water Supply

constant flow, no running expenses by the use of the **AQUARAM ENGINE**. Water delivered to any distance and height. If you have a spring, brook, or river, write for our catalogue **E. AQUARAM ENGINE CO.** 221 Fulton Street New York City

The Sawing Angle Isn't Always 45°

Some time you'll want to cut special angles and your mitre box won't have just the cut you want.

"Red Devil"
(Same make as famous "Red Devil" glass cutter)

THE SEAWEY
"RED DEVIL" MITRE BOX will cut any regular or special angle. Weighs two pounds and can be used for either inside or outside work. If your dealer hasn't it, send us \$2.00 and his name.

IT'S ANOTHER OF THE "RED DEVIL" FAMILY
SMITH & HEMENWAY CO.
150 Chambers Street New York City

Is Your Glove Stiff?

Put a little "3 in One" oil on fingers and palm and the leather becomes soft and pliable at once. The ball will stick better and glove will last twice as long. "3 in One" makes base ball cover and stitches stronger and hold longer. It also prevents rust on mask, fasteners, etc. Not sticky or greasy.

Write today for large free sample bottle and "3 in One" dictionary.
FREE
42 AZB Broadway, New York

Here's an unfailing guide to successful photography

Every kn. wn difficulty—its cause, remedy and prevention is fully treated. It enables you to get better pictures with less waste of material. Gives methods of experts, tested formulae, short cuts, secret systems, etc. Every branch of photography is fully covered in

The Library of Amateur Photography
Four big volumes completely classified and indexed. Owners say: "The explanations are so exceedingly simple, and at the same time so thorough, that the most novice can readily understand them." And "They seem to cover the whole photographic field." Sent on approval, charges prepaid, on receipt of \$2. or write for further descriptive matter to

AMERICAN PHOTO TEXT BOOK CO.
3324 Adams Ave., Scranton, Pa.
11th, prospectus of 10 vol. professional set mailed on request.

BRINGS IT TO YOU—GET IT NOW

9,059-Word Business Book Free

Simply send us a postal and ask for our free illustrated 9,059-word Business Booklet which tells how priceless Business Experience, acquired from the lives of 112 big, broad, brainy business men may be made yours—your to boost your salary, to increase your profits. This free booklet deals with

- How to manage a business
- How to sell goods
- How to get money by mail
- How to buy at rock-bottom
- How to collect money
- How to stop cost leaks
- How to train and handle men
- How to get and hold a position
- How to advertise a business
- How to devise office methods

Sending for this free book binds you to nothing, involves you in no obligation, yet it may be the means of starting you on a broader career. Surely you will not deny yourself this privilege, when it involves only the risk of a postal—a penny! Simply say "Send on your 9,059-word Booklet." Send to

SYSTEM, Department 50-3, Wabash and Madison, CHICAGO.

Electric Light and Power

Day and Night Service The Junior No. 1 Equipment

Direct Connected Dynamo, Gasoline Engine Set, Complete Switchboard, 16-Cell "American" Storage Battery \$265

The most complete, reliable equipment ever offered at this price. We want a representative in every county. **AMERICAN BATTERY COMPANY** Est. 1889 1141 Fulton St., Chicago

Print Your Own

Cards, circulars, books, newspaper. From \$5. Larger \$10. Rotary \$15. Save money. Big profit printing for others. All easy, mine sent. Write factory for press catalog, TYPE, cards, paper, etc.

THE PRESS CO., Meriden, Connecticut

Fish Will Bite

like hungry wolves, fill your nets traps or trot line with **Magic-Fish-Lure.**

Best fish bait ever discovered. Keeps you busy pulling them out. Write to-day and get a box to help introduce it in your neighborhood. Agents wanted. **J. F. Gregory, 2-25, St. Louis, Mo**

Make \$20 a Day

with our wonderful **Champion Picture Machine**. Takes, develops, finishes photo in half minute; 500 an hour. No dark room. Experience unnecessary. Photo Post Cards and Buttons all the rage! You can make money anywhere. Small investment, big profits. Be your own boss. Write for Free Book, Testimonials, etc. **AMERICAN MINUTE PHOTO CO.** 454 N. Dear St., Chicago, Ill.

A SOUVENIR

Or a "Suggestion Gift" for the Automobile Enthusiast.

A Miniature Rubber Auto Tire Flaps Tire, 10c; Watch Fob, 25c; Auto Wheel Paper Weight, 25c; Auto Wheel Watch Fob, 25c. These are the most popular, attractive automobile novelties on sale to-day. Send price for a sample. Prices in quantities with special lettering on request. We want more live agents.

Oakland Advertising Co., Dept. A, Akron, Ohio

STUDY High-Grade LAW Instruction by Correspondence

Prepares for the bar. Three Courses: College, Post-Graduate and Business Law. Nineteen months. Classes begin each month. Send for catalog giving rules for admission to the bar of the several states.

Chicago Correspondence School of Law 506 Kemper Block, Chicago

Incorporate

YOUR PATENTS and BUSINESS in ARIZONA

Laws the most liberal. Expense the least. Hold meetings, transact business anywhere. Blanks, By-Laws and forms for making stock full-paid for cash, property or services, free. President Stoddard, FORMER SECRETARY OF ARIZONA, resident agent for many thousand companies. Reference: Any bank in Arizona.

STODDARD INCORPORATING COMPANY, Box 8000 PHOENIX, ARIZONA

VACUUM PUMPS

PRESSURE BLOWERS

For Powerful Portable and Stationary Vacuum Cleaning Plants. They take up their own wear. Powerful; Noiseless; can't get out of order; for gas and oil appliances.

Blower Catalog No. 215—Vacuum 254

LEIMAN BROS. 62EW John Street, New York

ELECTRICITY

Complete in One Year

SCIENTIFIC ELECTRICITY IN ALL ITS BRANCHES

BLISS ELECTRICAL SCHOOL

Studies restricted to theoretical and practical electricity, mechanics, drawing and necessary engineering knowledge. Actual construction of apparatus, installation and testing right in the school. Technicians concentrated and hard work. For young men of energy and character. 20 Years of greatest success. Hundreds of graduates hold first-class positions. Opens Sept. 25. Write for new catalogue.

20 Tacoma Avenue, WASHINGTON, D. C.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12624) V. W. C. asks: Regarding the article on the exhaustion of the atmospheric supply of oxygen which appeared in a recent issue: Is not this an improbable event? For does not chemistry teach us that we cannot destroy anything, any element, but only change it? A. The warning concerning the exhaustion of atmospheric oxygen does not seem to us so needless. The oxygen in water and silica is not in a condition for use, and in the case of silica there is no known way to make it useful. The heat of the electric furnace is the only way we have of decomposing silica, excepting for the small amount which plants can use. The carbon dioxide is reduced by plant life very easily and its carbon returned to a usable form in wood and other vegetable matter; and, on the other hand, the vegetable matter is in turn changed back to carbon dioxide and other compounds by the life processes of animals. These two great kingdoms of nature the vegetable and the animal, act together to maintain a balance of the resources of the earth for the support of her children in both of these kingdoms. Neither plants nor animals can directly employ carbon and oxygen in their vital processes. They use them in the form of compounds, excepting for the action of oxygen upon the venous blood in the lungs.

(12625) O. C. E. asks: If a river with six feet of water in it freezes over, and the ice is frozen to a depth of two feet, what will be the temperature of the water under this ice? Why the question was brought about was this: It seems that if a body of water either running or standing still will freeze to a depth of two feet, it may be cold enough to freeze to the bottom, but it does not, and I suppose there is a protection by this ice to the water underneath. I mean a protection from the atmosphere above. This no doubt keeps the ice from freezing solid. A. The temperature of fresh water under ice is always 39 deg. Fahr., since this is the temperature of greatest density of water. Water either colder or warmer than 39 deg. always floats on water at 39 deg., and as water is a non-conductor of heat, the water under the ice does not become any warmer or colder than 39 deg., excepting close to the under side of the ice, and here it cools to 32 deg. and then freezes. Ice increases in thickness by the freezing of the water in contact with the under side of the ice. If the cold of the winter were prolonged enough to freeze a pond to the bottom, it would freeze to the bottom. Water is prevented from freezing by the atmosphere. The heat of the water is radiated through the atmosphere slowly, and the water is frozen, although the air retards this process.

(12626) D. R. S. asks: Will you please explain why it is that, when looking at the moon or any bright light through an ordinary screen, four streams of light are given off in the shape of a cross? A. Bands of light are seen extending out from a bright light, as you show them in your letter, because of what is termed *diffraction* in optics. It is produced by the meshes of the cloth screen. These are at right angles to each other, and so the bands of light are at right angles to each other. The explanation of diffraction is not easy. A good presentation of the subject in a simple way is in Carhart's "College Physics," which we will send for \$1.50.

(12627) C. C. asks: 1. When far into the wilds of Canada, both East and West, I have at times heard a strange sound like a drum coming from away back. It starts slowly, then quicker and louder, and then slows down again and dies away, then after a minute it starts again, and so on for hours. It is called "St. Patrick's drum," by woodmen and prospectors. Is it known to scientists, and what is the cause? A. We have never heard of St. Patrick's drum before. Can it be the drumming of the partridge? This bird beats with its wings and makes a noise which is called in the East a drumming. We do not think of any other sound of the sort. 2. Why is it that a man will travel in a circle when lost in the woods, and as he will sometimes do on the water? A. We explain the traveling in a circle in the forest by the fact that one leg is stronger than the other, and thus it forces the man out of a straight course. Usually the right leg is the stronger, and a man circles toward the left. We have never seen any theory about the matter, and make this as a suggestion.

(12628) D. W. asks: What is 1/20 milligramme in ounces avoirdupois? A. One gramme is equal to 0.035274 ounce avoirdupois. From this you can calculate that 1/20 of a milligramme is equal to 0.0000017637 ounce avoirdupois. This is somewhat more than 1/600,000 of an ounce.

Impressive Business Stationery Readily Secured at a Usable Price

You need it; you can get it—easily—in the 150 principal cities in the United States where the most responsible printers and lithographers carry in stock

CONSTRUCTION BOND

Let us send you the names of those concerns in your locality who recommend Construction Bond, because it helps them give you better stationery for your money. Here's the reason:

Construction Bond is sold *direct* to these responsible printers and lithographers only; it is *always* sold and handled 500 lbs. or more at a time. Other fine bond papers are sold *through local jobbers* to any printer, as little as 10 lbs. at a time. The economics of our method of distribution have brought us the support of the most important printers and lithographers in the United States—the very concerns who are *best* able to produce stationery of the character you want.

To specify and *secure* Construction Bond is to be sure of getting good paper, good work on it, and the utmost value for your money. Send us your business card and receive *free* our portfolio of handsome specimen letterheads and names of those who can supply you Impressive Stationery at a Usable Price on Construction Bond.

W. E. WROE & CO., Sales Office, 1015 Michigan Ave., Chicago



Some

REMINGTON Typewriter Figures

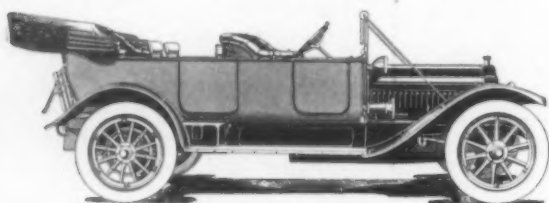
- 583 The number of Remington Typewriter Salesrooms throughout the World.
- 1,011 The number of different keyboards furnished on the Remington Typewriter.
- 117 The number of different styles of type with which Remington Typewriters are equipped.
- 84 The number of languages written on the Remington Typewriter.
- 347 The number of different Totalizers furnished on the Remington Adding and Subtracting Typewriter (Wahl Adding Mechanism).
- 29% The increase in Remington Typewriter Sales during the past year over any previous year since the beginning.
- 750,000 The number of Remington Typewriters in use today—more than any other make and more than many others combined.

Remington Typewriter Company
(Incorporated)
New York and Everywhere



WHITE MOTOR CARS

ELECTRICALLY STARTED AND LIGHTED



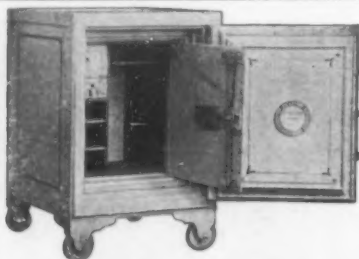
WHITE CARS are equipped with a starting system that cranks the motor easily and naturally. There are no valves to leak, no gears to engage, and no explosions in the cylinders while the pistons are stationary. The White starting system is one hundred per cent efficient. Moreover, the lights are operated by the same system that starts the engine. Logical, isn't it?

"THE CAR THAT MADE LONG STROKE FAMOUS"

The White  Company

CLEVELAND

MANUFACTURERS OF
GASOLINE MOTOR CARS, TRUCKS AND TAXICABS



Protection for valuables in the ideal home

WHEN so good a Safe as the Herring-Hall-Marvin can be purchased for \$30 and up, there are few homes that cannot afford to own one.

Can YOU afford NOT to?

Your silverware and jewelry are worth how much?

Your securities, policies and other private papers?

In the event of robbers or dishonest servants—or fire—where would your valuables be? Surely a safe would enable you to feel more secure concerning them.

The Herring-Hall-Marvin Safe proves in every fire. It is constructed by experts and will stand severe stress and strain. Interior can be arranged to suit your needs.

No matter where you are we can supply you with a Safe. A request for a catalogue or for a salesman to call will be appreciated.

A few uncovered spots open for representatives,
address E. K. Poor, Gen'l Sales Manager, Hamil-
ton, Ohio, or J. A. Reynolds, New York Sales
Manager, 400 Broadway—whichever is nearest.

HERRING-HALL-MARVIN SAFE CO.

The OLDEST and LARGEST Safe Company in America

400 Broadway New York City

Hamilton, O. Agencies in all the Large American and Foreign Cities Chicago, Ill.

Our Coast Defenses

May 18th Issue

Many of the readers of the Scientific American will remember the Coast Defense Number, which was published at the time of the Spanish War. At that date we had made some progress in carrying out the system of coast defenses which had been outlined by the Endicott Board. During the intervening years the system of fortifications as thus laid down, has been practically completed. In respect of the number and power of the guns mounted, the provision which has been made for their proper training, and the elaborate system of mining which forms a most important part of our defenses, the United States system is probably more elaborate and more expensive than that of any other country.

In the May Magazine Number of the Scientific American which will be published on May 18, 1912, we shall give a description of this great work, in which the text will be assisted by an unusually fine set of photographs showing the latest guns, emplacements and general coast defense material.

Among the notable chapters will be one describing the principal guns that are mounted or about to be mounted along the sea coast. These will include the big 16-inch gun, the heaviest weapon in the world today, and the new 14-inch gun, which in the future will form the principal arm of defense.

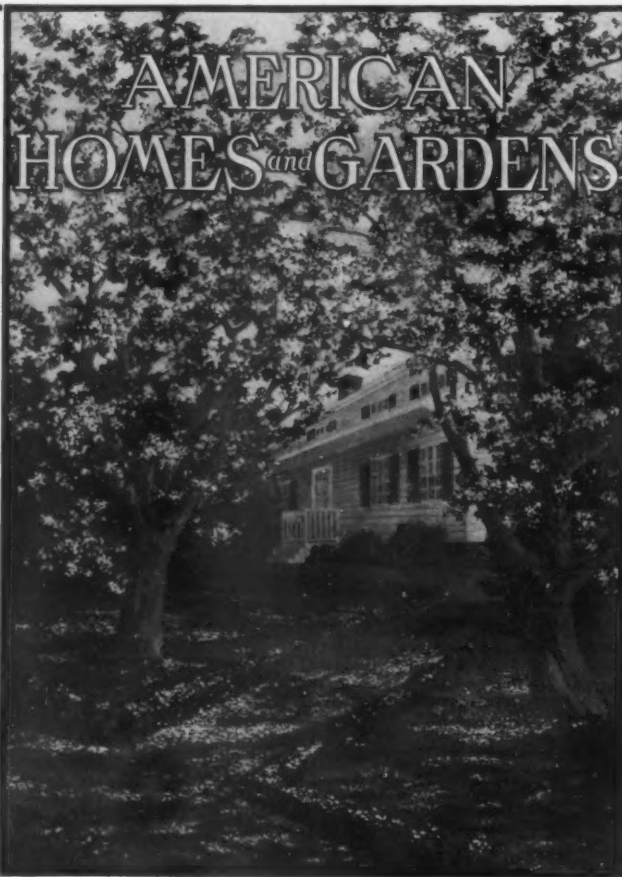
Another chapter will be devoted to projectiles and the work they have done on the target. These will prove that in spite of the great advance which the armor plate makers have made, the gun is at present victor over the plate.

Of particular interest will be the chapter describing the elaborate method by which our guns are trained upon an enemy, and showing how, by an elaborate system of range finding, it is possible to plot the course of a hostile vessel with absolute accuracy.

Perhaps the element of our defenses which would most be dreaded by a hostile fleet is the system of submarine mining, to which our army officers have devoted a great deal of care and upon which large sums of money have been expended. The mines, and the method by which they are planted and fired, will be illustrated and fully described.

In addition to the articles devoted to our coast defenses, the number will contain the characteristic material of the regular Scientific American issue, such as the editorials, the page of notes, and the various sections devoted to the current news of the day, Science Abstracts, and Inventions.

The number will be inclosed in a handsome colored cover representing the firing of one of our coast defense guns.



ANNUAL SMALL HOUSE NUMBER

American Homes and Gardens

Special Number
Price 50 Cents

MAY, 1912

Special Number
Price 50 Cents

The May "Small House Number" of AMERICAN HOMES AND GARDENS is a handbook of its subject for the homemaker. Superbly illustrated by halftones and complete floor plans of 18 attractive houses of low cost. Numerous other excellent homes and garden features.

MUNN & CO., Incorporated, Publishers, 361 Broadway, New York

1875

The Prudential

Home Offices

1912



The Prudential

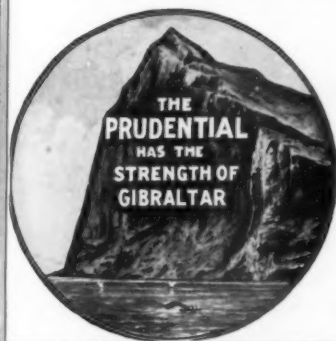
Founded by John F. Dryden, Pioneer of Industrial Insurance in America

GREATEST YEAR OF STRENGTH AND USEFULNESS ANNUAL STATEMENT, DECEMBER 31, 1911

Assets, over - - - - - 259 Million Dollars
Liabilities, nearly - - - - - 241 Million Dollars
Income in 1911, over - - - - - 81 Million Dollars
Capital and Surplus, over - - - - - 18 Million Dollars
Paid Policyholders in 1911, over - - - - - 27 Million Dollars

Life Insurance Issued and Paid for in 1911, over 440 Million Dollars
Increase in Paid-for Insurance in Force, over 167 Million Dollars
Liabilities include Policy Dividends - - - 29½ Million Dollars
of which there is payable in 1912 - - - 4¾ Million Dollars

Total Paid Policyholders since organization, plus amount held at interest to their credit, over - - - 466 Million Dollars



NUMBER OF POLICIES IN FORCE, OVER - - - 10 MILLIONS
PAID-FOR INSURANCE IN FORCE, OVER - - - 2 BILLION DOLLARS

Number of Individual Claims Paid Since Organization - - - - - 1½ Million

Send for particulars of the Prudential policy, providing a Guaranteed Monthly Income for yourself or wife. A life-long protection for your dear ones, or your own old age.

The Prudential Insurance Company of America

Incorporated as a Stock Company by the State of New Jersey
Forrest F. Dryden, President

Home Office, Newark, N. J.

Without committing myself to any action, I shall be glad to receive free particulars and rates of an IMMEDIATE BENEFIT and CONTINUOUS Monthly Income Policy.

SEND THIS COUPON TODAY
For \$.....a Month with Cash Payment at Once
Name.....
Address.....
Occupation.....
My Age is.....
Beneficiary's Age..... Dept. 121
You and Yours Need This Protection

The Ideal Home Is the Home Protected by Prudential Life Insurance

SCIENTIFIC AMERICAN HANDBOOK OF TRAVEL

With Hints for the Ocean Voyage for European
Tours and a Practical Guide to London and Paris

By ALBERT A. HOPKINS, Editor of Scientific American Reference Book

At last the ideal guide, the result of twenty years of study and travel, is completed. It is endorsed by every steamship and railroad company in Europe. To those who are not planning a trip it is equally informing. Send for illustrated circular containing one hundred questions out of 2,500 this book will answer. It is mailed free and will give some kind of an idea of the contents of this unique book, which should be in the hands of all readers of the Scientific American. It tells you exactly what you wish to know about a trip abroad and the ocean voyage.



WHAT THE BOOK CONTAINS

500 Illustrations The Sea and Its Navigation
6 Color Plates Statistical Information
9 Maps in pocket Automobiling in Europe
All About Ships 400 Tours, with prices
"A Safer Sea" Practical Guide to London
Ocean Records Practical Guide to Paris
Names 2,000 Hotels, with prices

500 PAGES, 500 ILLUSTRATIONS
FLEXIBLE COVER, \$2.00—FULL
LEATHER, \$2.50 POSTPAID

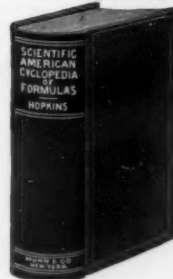
MUNN & CO., Inc., Publishers, 361 Broadway, New York City

The Scientific American Cyclopedia of Formulas

The Most Complete and Authoritative Book of Receipts Published

Partly Based on the Twenty-Eighth Edition of
The Scientific American Cyclopedia of Receipts, Notes and Queries

Edited by ALBERT A. HOPKINS, Query Editor of the Scientific American



THIS is practically a new book and has called for the work of a corps of specialists for more than two years. Over 15,000 of the most useful formulas and processes, carefully selected from a collection of nearly 150,000, are contained in this most valuable volume, nearly every branch of the useful arts being represented. Never before has such a large collection of really valuable formulas, useful to everyone, been offered to the public. The formulas are classified and arranged into chapters containing related subjects, while a complete index, made by professional librarians, renders it easy to find any formula desired.

"As Indispensable as a Dictionary and More Useful"

Following is a List of the Chapters:

- | | |
|--|---|
| I. Accidents and Emergencies. | XV. Insecticides, Extermination of Vermin |
| II. Agriculture. | XVI. Lapidary Art, Bone, Ivory, etc. |
| III. Alloys and Amalgams. | XVII. Leather. |
| IV. Art and Artists' Materials. | XVIII. Lubricants. |
| V. Beverages; Non-Alcoholic and Alcoholic. | XIX. Paints, Varnishes, etc. |
| VI. Cleansing, Bleaching, Renovating and Protecting. | XX. Photography. |
| VII. Cements, Glues, Pastes and Mucilages. | XXI. Preserving, Canning, Pickling, etc. |
| VIII. Coloring of Metals, Bronzing, etc. | XXII. Rubber, Gutta-Percha and Celluloid |
| IX. Dyeing. | XXIII. Soaps and Candles. |
| X. Electrometallurgy and Coating of Metals. | XXIV. Soldering. |
| XI. Glass. | XXV. Toilet Preparations, including Perfumery. |
| XII. Heat Treatment of Metals. | XXVI. Waterproofing and Fireproofing. |
| XIII. Household Formulas. | XXVII. Writing Material. |
| XIV. Ice Cream and Confectionery. | Appendix: Miscellaneous Formulas; Chemical Manipulation; Weights and Measures; Index. |

SEND FOR DETAILED ILLUSTRATED PROSPECTUS

Octavo (6½ x 8¾ inches), 1,077 Pages, 200 Illustrations
Price, in Cloth, \$5.00, Net. Half Morocco, \$6.50, Net, Postpaid

MUNN & CO., Inc. Publishers, 361 Broadway, New York City

The Columbia

Phonograph Company (exclusively) presents:



- | | |
|--------------------------------|----------------------------------|
| ¹ Lillian Nordica | ² Mary Garden |
| ³ David Bispham | ⁴ Olive Fremstad |
| ⁵ Alice Nielsen | ⁶ Josef Hofmann |
| ⁷ Ellison Van Hoose | ⁸ Bernice de Pasquali |
| ⁹ Kitty Cheatham | ¹⁰ Jose Mardones |
| ¹¹ Reed Miller | ¹² Rosa Olitzka |
| ¹³ Xaver Scharwenka | ¹⁴ Carolina White |
| ¹⁵ Ruth Vincent | ¹⁶ Cecil Fanning |
| ¹⁷ Margaret Keyes | ¹⁸ Alex. Heinemann |

Photo (C) by
Mickin
Dupont &
Channel

IF YOU have not yet realized the marvelous truth and vitality of the music of the Columbia Grafonola, we are sure that your opinion was formulated in 1907 or earlier—and since then a revolution has been wrought. We want to say this courteously; but we do insist upon it.



Columbia Grafonola
"Regent," \$200



Columbia Grafonola
"Regent Junior," \$150



Columbia Grafonola
"Baby Regent," \$100



TRADE MARK

IF WE are right you are the one who has missed the most. Will you do just this one thing: Go to the nearest Columbia dealer (we can give you his name) and ask him to let you hear any record, by any of the great artists named above, played on any model of the Columbia Grafonola. Don't be too sure that you know already. We predict a few minutes of delighted astonishment for which you are likely to thank us.

COLUMBIA PHONOGRAPH CO., Gen'l

Box 264, Tribune Building New York
London, Earlsfield, S. W.

Toronto, McKinnon Building
Mexico City, 1-A Calle de Lopez, No. 7